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GUY'S HOSPITAL REPORTS.

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RICHARD WATTS, CROWN COURT, TEMPLE BAR.

W. R. Cooke

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INTRODUCTION

TO

THE SECOND VOLUME.

IN commencing a Second Volume of the Guy's Hospital Reports, we are desirous of engaging the attention of our readers by a retrospective glance at the First; for the purpose of shewing, that our promises have been faithfully performed; that no false estimate was formed of our resources; that the work has been accomplished in full accordance with the spirit in which it was undertaken; and that no insurmountable obstacles have occurred, to hinder our progress, or disappoint our expectations.

Among the various reasons which presented themselves in favour of this undertaking, the following appeared to have the greatest weight. It was conceived, that an Hospital and School of Medicine so complete and extensive as Guy's, embracing, both in theory and practice, the whole range of Sciences connected with the Healing Art, afforded a store of information worthy of being extended beyond the narrow limits of oral instruction; that the medical officers and teachers would gladly avail themselves of a proper and convenient medium, through which to publish such facts or observations as would with less propriety find a place in a systematic or separate treatise; that the pupils, with great advantage to themselves, would willingly render assistance in taking reports; that, should monographs be scarce, individual cases of some peculiar

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interest would amply abound; that all information would be authentic, as emanating from those who possessed the best opportunity of obtaining correct statements; and, finally, that as utility, not pecuniary recompence, was the object in view, no reasonable expense need be spared in introducing tables, drawings, and diagrams, for the illustration of a work which might nevertheless be offered at a very moderate price.

It was anticipated, that these Reports would prove useful to the pupils of Guy's, by giving a stimulus to their clinical pursuits; that they would be acceptable to others, by increasing their acquaintance with the practice of one of the leading schools of the metropolis; and that they would be generally received as a laudable and promising endeavour to throw open a large emporium of knowledge, hitherto almost entirely closed.

Our expectations have been fulfilled, in the efficient support of our contributors, in the effects produced upon the Medical School, and in the estimation in which the attempt has been held by a considerable number of the profession. We are not disposed to deny, that some difficulties have been experienced at the outset of our course; but all impediments have now been removed; and such arrangements and provisions have been made for the future, as place us completely at ease, and give us strength to pursue our career with still increasing vigour.

Some cases, it will be observed, have been reported at full length, while some have been but briefly noticed; and others have been collected in large numbers, and condensed in a tabular arrangement.

When numerous cases are brought together to illustrate some particular point, the description of each is necessarily brief, and confined to the circumstances which appear to bear directly upon the question under consideration. Again,

when the occurrence of a disease in a particular instance supplies, as it were, a text to some general remarks upon the class to which it belongs, such points only are noticed as serve the author's purpose, exemplifying his meaning, and forming the foundation of his reasoning; but other cases, introduced for the sake of their intrinsic interest, would suffer materially by being curtailed of the most minute particulars: under the former circumstances, such extracts only are employed as give force and perspicuity to the narration, explain the inferences, and bear testimony to the justice of the conclusions: under the latter, the whole evidence is laid before the reader, and all the details are stated, in order to afford him the best opportunity of drawing from them his own deductions.

Of separate and unconnected cases, a much smaller proportion will be found than was originally contemplated, or than the unostentatious title of "Reports" might perhaps have led persons to expect. But if original papers appear to occupy a larger share of space than is desirable, we must plead guilty to an error of judgment, as this has arisen not from necessity, but choice. The records of the Hospital contained in the clinical and inspection books would furnish ample materials for many such volumes as that which we have put forth: but who would prefer the raw material to the well-wrought manufacture; or esteem bare facts more interesting than cautious deductions, general conclusions, lessons of experience, and rules of practice laid down by teachers who possess such vast opportunities for medical and pathological observation? The single cases which have been reported will hardly be deemed the most valuable part of our Numbers; and few, we imagine, would demand from us a larger collection of them, to the exclusion of the more elaborate articles.

It was formerly urged upon us, that a series of Reports was not likely to meet with success, unless it embraced information from several of the London Hospitals: now, not to mention

the impracticability of uniting in one common object, institutions with separate interests and under distinct rule, the experience of the last twelvemonth assures us that it is owing to many peculiar advantages, which cannot be extended beyond our own walls, that we are enabled to accomplish our purpose. Each Number, moreover, has invariably been swelled beyond the prescribed size, by a superabundance of matter; and, as we are not compelled to seek external aid, we hope we shall be considered justified in trusting to our own resources.

From another quarter proceeded a prediction, that our best endeavours would be fruitless, unless abstracts from recent works, critical disquisitions, and the floating information of the day on professional topics, were mingled with original compositions. Other medical periodicals, it was said, by this happy combination of entertainment with utility, gratified the public taste, extended their circulation, assumed a supreme authority over the members of the profession to pronounce censure and approbation, and exercised a powerful influence over their opinions, characters, and success. But in order that our pretensions may be rightly understood, it is necessary to draw between this work and the periodical reviews a wide line of demarcation. The contributors to these Reports, induced to communicate the results of their own labours, by the opportunities they enjoy, and the position in which they are placed, and more anxious to advance knowledge by adding something to the common stock, than to pass judgment upon the works of their neighbours, are, from their habits and inclinations, alike unfit for the task of anonymous publication. Criticism is, therefore totally avoided: Medicine, and the Sciences connected with it, are alone to be expected in our pages: and utility is the test by which they must be either rejected or approved. Again, we were told, that if we entered the field of contention, we must take care to meet our opponents with equal arms. Such advice, however, could only

emanate from a total misconception of our plan and motives: all thoughts of hostility we utterly disclaim; we assume no weapons either for attack or defence; we strive not as warriors, but as cultivators of a productive soil, whereon many may labour, unmolested and unmolested, and be well required for their pains.

It would be presumptuous to attribute to the publication of these Reports the great extension of clinical pursuits among the pupils of the Hospital, which has been observable since the commencement of the present session: perhaps, with greater justice, the two occurrences are assignable to a common cause; namely, an enterprising but cautious spirit of improvement. It cannot be denied, however, that such a result was expected, and has actually taken place. At no former period has so ardent and general a desire been manifested to obtain information by study at the bed-side.

A satisfactory proof of the truth of this assertion is shewn in the establishment of an institution, at present peculiar to Guy's: we allude to the Clinical Report Society, by means of which no less than twenty students are engaged in the close and practical investigation of disease; the whole Hospital is rendered subservient to the most important purposes of a clinical ward; and all the cases which are received within its walls are observed and recorded with a greater or less degree of minuteness, as circumstances may direct.*

The utility of this society is obvious. It is by no means to be considered as raised in opposition to the long-established clinical wards; nor as offering a substitute for those invaluable schools of practical knowledge. Never have their merits been more justly appreciated, than at the present time; and never did the names of so many candidates for clinical clerkships appear upon the books. Each student who has passed three

* The total number of members, at present, is eighty-two.

months in the clinical wards is ready to admit that that period has proved the most profitable portion of his medical education, and regrets the necessity for resigning his office at the moment when he has just learnt to turn it to the best account. The clinical wards, then, acknowledge a most useful adjunct in the Clinical Society. In the former, under the guidance of experienced physicians, the student is instructed how to make observations upon the sick, and to interpret the signs of disease: in the latter, he still enjoys the advantage of applying these lessons.

To an association so beneficial to the pupils, the authorities of the Hospital have afforded sanction and encouragement, and have rendered every assistance calculated to promote its operations. An apartment has been appropriated to the meetings of the society, and the preservation of its books; an amanuensis has been engaged to copy the reports; and a committee of senior pupils appointed to superintend the proceedings.

The first suggestion of this Society is, we believe, due to Mr. Blackburn, now of Liverpool; who also laboured zealously and successfully in arranging the details, and in bringing the several parts of the machinery to work with regularity and effect.

Besides the advantage of this exercise of clinical observation to the persons engaged in it, another important object is at the same time attained; namely, a far more extensive record of cases than has been hitherto effected in this country: and we are not without hopes, that, at a future time, we shall be enabled to communicate, from this source, some interesting cases, and valuable information relating to the statistics of disease.

It is not, however, our intention to offer any pledge on the subject of future articles; nor to lay down an invariable law as to the size of the Numbers, or the time of their appearance;—

to do which, would, in some respects, be attended with advantage, but would at the same time be accompanied with more than an equal inconvenience. We shall, on the contrary, assume the liberty of publishing such Papers as we may think fit; without hurrying what is unfinished, or withholding what is complete, in order to observe a precise rule in respect to time and quantity. The present Volume will consist of Two Parts, whilst the former was made up of Three; and it is not improbable that, in the following year, the quarterly periods may be adopted. All that can be reasonably demanded, is, a strict adherence to the notice printed on the cover respecting the time of publication; and a price affixed to each Number, bearing a just proportion to its extent.

PRACTICAL VIEW
OF
LITHOTRITY:
WITH REMARKS ON THE
LATERAL OPERATION OF LITHOTOMY.
BY MR. ASTON KEY.

THE merits, the dangers, and the difficulties of Lithotritry are not yet so justly appreciated by the Profession, as to render an examination of them either unnecessary or uninteresting. The former are magnified by its friends and advocates: the latter, by its enemies. The object of this Paper shall be, to exhibit, in its proper light, the advantage which this operation holds out; while the dangers to which it exposes the patient shall be fairly stated and impartially canvassed.

Lithotritry is, in some respects, peculiarly unfortunate. It is an art that has done much, and promises more, toward the alleviation of human suffering; and is creditable alike to those who first discovered its practicability, and to those who have advanced it. But it has suffered, I had almost said, equally from its friends and from its opponents. That it should meet with enemies who would seize every opportunity of decrying it, is what a very little acquaintance with human nature, or with the progress of discovery generally, would lead one to expect. Some would endeavour to check its advances, from a dislike of innovation: others would distrust and doubt its merits, from the circumstance of its being an exclusive art, and not practised by the general surgeon. There are others, again, who would dislike to see the operation of lithotomy superseded, from less worthy motives: and there is yet another class of persons, who, with honest intentions, but with lack of knowledge and judgment,

declaim loudly against the operation, as unsuccessful and unsafe. This kind of opposition lithotrity has met with in abundance. The question for the dispassionate observer to answer, is, Whether this has not been owing rather to the exaggerated reports of its merits by its professors and its advocates, than to the active hostility of those who doubt its pretensions.

In this country, at least, it will not be maintained that lithotrity has not met with the encouragement it deserved, both from the profession and the public. The latter was led to believe, that a painless, a certain, and a safe operation for the removal of one of the most afflicting maladies was about to be introduced; and, with this impression, those who laboured under the disease flocked to the lithotritist, to save them from the horrors of the knife. The majority of the profession gave to it the support which it seemed to deserve—some to the verge of credulity, believing it to be altogether free from danger: others, with more discretion, regarding it as an operation that might, in many cases, avert the danger of lithotomy. Whatever may now be the estimate of the value of lithotrity, its first introduction was hailed generally as a valuable acquisition to surgery: and if its credit has in some degree declined, and its merits appear diminished, in the eyes of English surgeons, it is due to its own extravagant pretensions, and to a presumptuous and ill-judged competition with lithotomy, which, in a fair examination, it will hardly be found to maintain.

It is an invidious and a painful task to advert to the want of candour justly complained of in those who have exclusively practised the art. To this cause is to be attributed much of the distrust of lithotrity that many well-informed persons express. There has been, it cannot be denied by its friends, a blamable suppression of the dangers of the operation, and a withholding from the profession of unsuccessful and fatal cases; the patrons of the art having assumed the characters rather of strenuous partisans, than scientific cultivators of a useful branch of surgery. It would appear, that, in too many instances, the interests of lithotrity have been sacrificed to those of its professors. To forward the ends of the practitioners of the art, it has been unwisely

stated to possess advantages over lithotomy to which it has no claim. Lithotrity neither needs nor deserves such false support: it has merits of its own, by which it may fairly be tested; and should shun competition with an operation that has been sanctioned by the experience of years. Before a judgment can be formed of the comparative success of the two operations, the exclusive advocates of lithotrity must state the results of their cases, with as much candour and fairness as the English lithotomists have already evinced.

At present, there is but little chance of obtaining such a statement of the results of cases, as would enable us to draw a tolerably correct inference as to its comparative success. In France, the question has assumed the shape of a contest but little creditable to those engaged in it; but out of which, perhaps, something like the truth may hereafter be obtained. One party places lithotrity in a light too favourable for an unprejudiced person to give credence to their statements: the other, with equal vehemence, is opposed to the operation, and denounces it as a highly dangerous and unsuccessful branch of surgery. I have attempted in vain to reconcile the conflicting statements of Messrs. Velpeau and Civiale of the success of the operation; and can only suppose that the latter, when he enumerates 236 patients cured out of 244, employs the word "cured" in a different sense from that in which we understand it. That so large a proportion of cases of lithotrity should be cured, is a statement that surely carries with it its own refutation. M. Velpeau's reduction of this large number to 130 probably brings it nearer the truth.

It is needless for me to enter into the controversy between these two surgeons, as to a matter of fact. The data are not sufficiently explicit to enable me to solve the question, whether M. Civiale has overstated his success, or M. Velpeau has been led to take too unfavourable a view of M. Civiale's table of results: and even if I could arrive at the truth, it would be foreign to my purpose. It is not my intention to be a partisan of either side of the controversy; nor is it my object to take up lithotrity as opposed to lithotomy. The question has, indeed, assumed this aspect. It has grown into an unbecoming contest between the lithotritist and the lithotomist; as if the two operations were wholly opposed to one

another, and could not be made available, each in its own and proper sphere.

If it be intended, by the exclusive advocates and practitioners of lithotrity, to maintain, that, indiscriminately applied to all cases of stone in the bladder, it is a less painful, more safe, and more successful operation than lithotomy, I must be allowed to express my doubt. If it be proposed to introduce lithotrity to the entire exclusion of the knife, as an operation that holds out a better prospect to the sufferer under stone for the cure of his malady, I am disposed to think that society would suffer by the exchange: or if, in support of their exclusive views, the advocates of lithotrity claim for their operation a superiority of success, as compared with the results of lithotomy, I am prepared to say, and to prove, that the history of English lithotomy furnishes records of success that leaves lithotrity far behind.

To shew that lithotrity is neither so universally successful, nor so exclusively applicable as might be inferred, I shall briefly detail the cases that have passed under my observation, occurring in the practice of the two most able lithotritists of the day. In each of these cases I was consulted.—Others, strongly militating against the exclusive use of the operation, have come to my knowledge; but which, as not occurring in my own practice, I forbear to mention.

CASE 1.—In 1829, an Irish gentleman, Mr. H——, about 64 years of age, arrived in this country from Paris, to obtain professional advice for a vesical disorder. I learnt that he had undergone the operation of lithotrity under M. Civiale, about six weeks previously; and that the operation had been followed by acute inflammation of the bladder, for which M. Amusat was consulted. As soon as the cystitis subsided, he came over to this country, labouring under symptoms of stone in the bladder, which, in severity, I have only on one occasion seen exceeded. The desire to void urine was nearly incessant, and the attempt excruciating, and often unsuccessful. He lingered out a miserable existence for a few weeks, receiving such relief as medicine could afford. On passing a flexible catheter to relieve the bladder, I discovered a considerable fragment of stone. Sir

Astley Cooper saw this gentleman several times, and considered him beyond the reach of any operation. He died with his sufferings unmitigated.

CASE 2.—**Mr. E**—, between 50 and 60 years of age, had been annoyed for some time with symptoms of disorder, which **Mr. Giraud**, of Feversham, found to arise from a calculus in the bladder. He came to town, at the request of **Mr. Giraud**, to consult me. Finding the stone small, I gave him the alternative of the two operations. He preferred lithotritry; and went to a well-known operator, with a note of introduction from me. He underwent the operation; and the stone was broken down at several sittings. Before returning to Feversham, he called upon me, and seemed feverish and ill; and I learnt subsequently, from **Mr. Giraud**, that he died, with typhoid symptoms, shortly after his return into the country. An abscess was formed in the neck of the bladder, at the base of the prostate gland.

CASE 3.—A gentleman from the country, a patient of **Mr. Elliott**, of Stratford, was discovered to have stone in the bladder, and consulted me respecting it. Finding it to be small, I proposed to break it down; and employed **Charrière's** drill-instrument for the purpose. Meeting with several obstacles in the attempt, I abandoned it; and he afterwards was placed under the care of the same lithotritist, who broke up, as I was afterwards informed, a small phosphatic calculus. The patient left town with a very irritable bladder, and suffering much in voiding his urine. I subsequently heard, from **Mr. Elliott**, that he lived for twelve months, with increasing suffering. On his death, the bladder was discovered to be diseased, and several stones were found in it.

CASE 4.—I was desired to visit **Mr. N**—, aged 70, with **Mr. Burrows**, surgeon in the City, in order to ascertain if he had a calculus. He had been supposed to labour under stone, but it had not been detected. On sounding him, a calculus was immediately struck by the instrument, and gave me the impression of being large. I explained to him the different operations that might be performed for his relief;

and he gave the preference to lithotrity. The same operator met us at the patient's house; and sounded him with care, in order to ascertain the size of the stone, and the condition of the bladder. The former he discovered to be above the ordinary size; and the latter so irritable and contracted, that it would admit of a very small quantity of water only being injected. Under these circumstances, he was thought an unfavourable subject for lithotrity. I therefore removed the stone by the lateral operation, in the presence of the lithotritist and Mr. Burrows. The operation was difficult; and the extraction of the stone not easy, on account of its size, and the enlarged state of the prostate gland. He was convalescent at the end of the second week: and has remained, up to the present time (nearly five years), free from any symptoms of his former disorder.

CASE 5.—Admiral C—— wrote to me from Exeter, to make some inquiry respecting the operation of lithotomy; as he was suffering from a calculus in the bladder. I replied to his inquiries, and was requested to make the necessary arrangements for cutting him. In the meantime, I was informed, by a friend, that he had placed himself under the care of the same lithotritist, and that the stone had been successfully broken down. Admiral C—— left town, but quickly experienced symptoms of a return of his disorder; and one or two fragments were, I believe, again detected, and crushed. He was thus relieved for a time; but experienced a second return of his pains, and died not long after his return into Devon. On the examination of his body by a surgeon at Exeter, six or seven calculi were found, formed, as I was told, on the remnants of the original calculus.

CASE 6.—About nine years ago I operated on Mr. Saunders, of Tottenham, and removed a lithic-acid calculus. He recovered in a few days after the operation, which was performed with the assistance of Mr. Holt and Mr. Edward Cock. About three years ago he came to me again, with symptoms of stone; and, on sounding him, I discovered a small one, and told him that it was small enough to be

broken down. He placed himself under the care of the same lithotritist, who crushed a small phosphatic calculus. He left town as soon as he was pronounced cured. Almost immediately after his return home, his pains in making water increased so much, that he said the pain of the stone was as nothing. He became feverish; and his bladder would not retain urine for an hour. I saw him, at the request of his surgeon, Mr. Moon, and thought that he might have some fragments remaining in his bladder. I passed a catheter, but could not detect any. His extreme irritability of bladder prevented any accurate examination by injecting it with warm water. He was averse to this latter measure, from the pain which he had always suffered when it had been formerly done. He died without any mitigation of his symptoms taking place.

CASE 7.—In 1834, Dr. Cobb requested me to meet him in consultation respecting a Mr. L——, from Kent, who was suspected to have stone in his bladder. I sounded him, and, discovered a stone of a size well adapted for lithotrity; and as his bladder was not irritable, it was decided that the same lithotritist should operate upon him. The operation was performed at several sittings, and with success. I sounded Mr. L——, at the operator's request, before he left town, and could not discover any particle of stone remaining. Mr. L—— also expressed himself quite relieved from his former symptoms. He remains well, October 1836.

CASE 8.—I met Mr. Finch of Greenwich at the house of a gentleman nearly 80 years of age, who was much distressed by very urgent symptoms of urinary calculus. I was informed, that a lithotritist had sounded him, and, from his age, and the great irritability of his bladder, declined to operate. His health being good, I saw no objection to lithotomy being performed, notwithstanding the enlargement of his prostate gland, and the irritable state of the mucous lining of his bladder. The operation was performed in the presence of Sir Richard Dobson, Mr. Finch, and Mr. Lawson: it was difficult, on account of the great enlargement of the body and third lobe of the gland; and tedious, from

the number of stones, which were found to amount to twenty-seven. His convalescence was retarded by one or two small calculi passing by the wound ; and by an abscess of the prostate gland, that burst into the rectum. The symptoms of irritation caused by this subsided ; and when I heard of him, he was free from stone symptoms, and was in the enjoyment of good health.

CASE 9.—Mr. S——, a patient of Dr. P——, was found to labour under retention of urine, caused by the presence of a small calculus in the bladder. He was lately placed under a lithotritist's care, for the purpose of operation. The stone was crushed, and the patient supposed to be cured. I subsequently met Mr. S——, at the house of Dr. P——, and heard him describe symptoms that indicated the presence of fragments in the bladder. I expressed this opinion to him ; and told him to lose no time in applying to a lithotritist. Whether any further attempt was made to relieve him, I did not learn ; but he was seized with bleedings from the bladder, which, joined to the irritation that he experienced, in a week or two destroyed him. On a post-mortem examination, several calculi were found in the bladder ; and each was discovered, when broken, to be formed on a fragment of the crushed stone. A fungus had also shot forth from the cervix vesicæ, from which the bleeding had taken place.

CASE 10.—Mr. C——, a surgeon, was brought to me by Dr. Gordon, in order to ascertain if he had stone in the bladder ; as certain symptoms, of which he complained, were considered to depend on the presence of a calculus. On sounding him, I struck a small calculus ; and he expressed a desire to undergo the operation of lithotrity, under the same operator. After one stone was broken down, a second was discovered ; and he underwent several operations ; the operator telling him that he had crushed several entire calculi. Mr. C—— returned home, assured that he was freed from the cause of his disorder. I saw him in three weeks after the last operation, and his bladder still continued to be irritable ; but this symptom gradually

ceased; and he appeared, when I last saw him, to be altogether freed from his disorder.

CASE 11.—Mr. C —, from Yorkshire, aged 60, came to town, for the purpose of placing himself under the same lithotritist's hands, for the operation of lithotripsy. His bladder was so irritable, that water was with difficulty injected into it. After trying to allay the irritable state of the bladder for six weeks, the operator told him that his was not a case for lithotripsy. I was requested to see him. I found him with an exquisitely sensitive bladder, affected with a bloody catarrh: his pulse 120; skin hot; and desire to void urine continual. The operation of lithotomy appeared to promise no success, especially as he had lost a great deal of flesh during his visit to town. I endeavoured to allay the irritation caused by the previous introduction of instruments, and succeeded to a certain extent. On sounding him, I discovered a large stone, and a large prostate gland. The operation was performed at the end of January, in the presence of Mr. Camplin and two young friends. It was difficult, on account of the stone being closely embraced by the bladder: it measured five inches and a half in its widest circumference. He was slow in recovering; the bladder still remaining irritable, and continuing to secrete a bloody mucus. The wound healed soundly, and his appetite and rest returned; and before he left town, the bladder had, in some degree, lost its extreme irritability, under the use of the *uva ursi*. I heard of him during the past summer, and he was in the enjoyment of good health.

CASE 12. occurred in the person of a surgeon in active practice, who was seized with considerable hæmaturia after exercise, and soon complained of symptoms that gradually assumed the character of vesical calculus. On sounding him, a small stone was discovered; and he placed himself under the care of a lithotritist. The stone was crushed after three operations, and he obtained entire relief from his disorder. He now remains well.

Of these twelve patients, three were cured, and three underwent the operation of lithotomy. Of the remaining six who died, one sunk with abscess in the prostate gland soon after the operation; four with protracted sufferings, in consequence of fragments remaining in the bladder; and one with disease of the bladder, brought on or aggravated by the operation: but whether there were fragments left in the case of Mr. S—— I was unable to ascertain during life, and a post-mortem inspection was not made.

I believe that no surgeon conversant with lithotomy would expect so unsuccessful a result in these cases, if they had been all submitted to the knife. The three patients who could ~~not~~ undergo the operation of lithotrity, but were afterwards compelled to seek relief from the knife, recovered: and it is but reasonable to conclude, that some of the unsuccessful cases would have had a better result, had they been subjected to the same operation.

In the detail of the cases above mentioned, I trust it will not be supposed that I wish to cast any suspicion on the skill of the operators. I believe that all that lithotrity, in the most skilful hand, could effect, was done by the two able operators under whom the cases occurred. It is not the skill of the lithotritists, but the capability of the operation, that it is intended to impugn. I wish to shew, that, as an exclusive operation for the removal of stone from the bladder, lithotrity cannot maintain that rank which it has been made to assume; and that if indiscriminately adopted, to the abandonment of lithotomy, it would be found inferior to the latter operation, both in safety and success. The new operation should, on no account, be regarded in the light in which its exclusive advocates would place it—that is, as a substitute for the old; but as a valuable adjunct to it, and as furnishing the surgeon with an additional means of relieving a most alarming and painful disease. If this view be taken of it, it will, I think, be found to be one of the most useful inventions that modern surgery has added to her resources: for in many cases, if selected with judgment, it is not only equally effective with lithotomy, but more safe, and less painful in the performance.

It would be an injustice to an ingenious English surgeon,

to make any allusion to the infancy of the art, without coupling his name with the earliest attempts made to break down stones in the bladder*. Mr. Elderton has unquestionably the merit of being the first to construct an instrument for the purpose of crushing a calculus, and enabling the patient to discharge it by the urethra. I need not describe the instrument; as an account of it, with a drawing, was published by him in the *Edinburgh Medical and Surgical Journal* for April, in the year 1817. It is not used with a drill, as the earlier French instrument; but acts, on the principle of some of the modern inventions, with a screw and lever.

My first acquaintance with lithotrity did not prepossess me much in its favour. Many years ago, I obtained, through a friend at Paris, the three-branch instrument invented by Civiale, and constructed by Charrière, for the purpose of drilling the stone. The difficulty that I experienced in using it on the living subject, and the incomplete manner in which it crushed the shells of the stone after excavating its interior, induced me, after two or three unsuccessful trials, to abandon the operation, as imperfect.

A fresh impulse seemed, however, to be given to lithotrity, and many of the imperfections of Civiale's instrument to be obviated by the improvements suggested by Heurteloup. Soon after his arrival in this country, I invited him to lecture to the Surgical Class of Guy's Hospital; in order that the gentlemen who were studying there might, through him, be made acquainted with an art that I but very imperfectly understood. Baron Heurteloup politely accepted the invitation; and gave a full explanation of the instruments that he used, and of the advantages they possessed over those generally employed. The lecture did not embrace the general principles of the operation of lithotrity, but was confined to the mechanism of the instruments which he had invented. The ingenuity of these instruments, and the dexterity of the operator, were alike the subjects of admiration; but instead of simplifying the operation, they appeared to render it more complicated, by the multiplication of appliances. Each presented a new difficulty: so that I resolved

* It appears that he constructed this instrument so long ago as 1811.

to abandon all idea of lithotrity, until it became less complex, in its performance, and in the instruments required. It reminded me, indeed, of the apparatus major formerly used in lithotomy; and I accordingly did not despair of seeing the "brise coq," the "vergule," and the other intricate machinery, superseded by a simple but efficient instrument; as the apparatus major has been by the operation of Frère Jacques.

Accident soon led to the discovery of an instrument, as simple in its application as the former had been complicated, and possessing the additional merit of being more effective in accomplishing its purpose. Report attributes the idea of percussion to Baron Heurteloup having been compelled to finish an operation by striking the drill of his instrument, the bow being rendered unserviceable by an accident. His application to Mr. Weiss on the subject brought to light an instrument constructed, long previously, for the purpose of crushing a stone, and resembling in shape a catheter with a shortened beak. This instrument furnished the idea of the present lithotrite: it has undergone several modifications and improvements; but, in principle, the instrument now used is much the same as that originally constructed by Weiss.

Not long after the introduction of percussion into lithotrity, I had an opportunity of witnessing an operation by Baron Heurteloup, in which he used the hammer: the simplicity of the operation, the rapidity of its performance, and the apparent security with which the hammer was struck without giving pain to the patient, presented a favourable contrast to the slow and uncertain operation of the drill;—not the least remarkable part of the performance being the almost entire unconsciousness which the patient evinced of the instrument being struck; as the vice which held the percussor transmitted the vibrations into the bed on which he lay; so that the bladder scarcely felt the slightest shock when the hammer was used. In seizing the stone, the superiority of this over the three-branch instrument was evident. I left the baron's house impressed with his dexterity, as well as with the great improvement which the change in the instrument had wrought.

My conviction, that lithotrity would, in the course of time, supersede lithotomy, in many cases in which the latter was employed, was confirmed by the new features which percussion had given to the operation, and by the advantages it possessed over the former mode of crushing the stone by the drill, in the subsequent steps of breaking up the fragments. I had always had misgivings as to the efficacy of the "brise coq." Though ingeniously contrived for the purpose of crushing the fragments, which the three-branch instrument could not seize, and well adapted for this purpose when once it got them within its grasp, it did not seem well devised for seizing them. It was straight; and opened, by the divergence of its two blades, like a pair of forceps; and therefore could only be brought to act within a very limited sphere in the bladder. The difficulty of seizing small fragments with such an instrument must have been considerable, and the consequent risk of leaving small pieces of stone in the bladder great. This difficulty—and a main one it was in my view—was wholly obviated by the percussor, which could be brought to seize and to act nearly as well upon the scattered fragments as on the entire calculus. This seemed to be no slight improvement, in an operation, one principal danger of which was, that of leaving fragments in the bladder as nuclei for future stones.

From this time I began to study lithotrity, in the hope that it might be made available to the general surgeon, as an occasional substitute for the knife. With this view, I endeavoured to overcome the difficulties of using the instrument; to ascertain in what the dangers of the operation consisted; and to acquire, by frequent practice, that facility and readiness in manipulation, which lithotrity requires. My expectations have been fully realized. Since commencing the practice of lithotrity, I found that more than half the number of adults who have come under my care have been fit subjects for the operation; and that, in the majority of persons afflicted with calculus, it has decided advantages over lithotomy. One, among the principal advantages which lithotrity has conferred upon surgery, is the early application which patients are induced to make for the relief of their disorder.

Formerly, it was a matter of notoriety to all surgeons, that patients labouring, or suspected to labour, under calculous disorders entertained a feeling of dread, almost amounting to horror, at the idea of having a stone in the bladder. The disease was associated in their minds with a most painful and dangerous operation, that must be had recourse to, as a last remedy, when palliative measures failed to afford relief to their sufferings. The dangers and sufferings of lithotomy, magnified as they were by the patient's fears, often deterred him from applying for medical assistance, when the pains of stone first came upon him, by the dread of having his worst fears confirmed. Even if the presence of a stone in his bladder were ascertained, it was, in too many instances, allowed to remain undisturbed, in the vain expectation that it might not increase in size, and that the severity of pain might continue to be mitigated by the medicine that so often had been found to assuage his pangs. The operation was thus procrastinated, until the stone acquired a large size—often until the bladder had become diseased, and the patient's health undermined by protracted sufferings. The knife, it was thought, could be at any time employed; and its use was too frequently deferred till it became impracticable.

The change that has taken place in the feelings of persons who are troubled with calculus is attributable to lithotrity. It is one, certainly not the least, among the benefits conferred on such sufferers by the introduction of this operation. They no longer entertain the dread of their symptoms depending on the presence of a stone: and when the stone is found, they cheerfully make up their minds to undergo an operation, which they regard as free from danger, and nearly so from pain. I have known a patient, and more than one, to be pleased with the discovery of a stone in the bladder; convinced, as he expressed it, that he could look for an easy cure from the new operation. The exaggerated statements of the advantages of lithotrity have thus not been unattended with good: they have been the means of inducing persons to come forward to obtain relief, when the disease was incipient, and the stone small.

Nor has it been without its influence on the surgeon.

Formerly, when a patient first consulted him for symptoms of dysuria followed by pain, he was content to palliate the malady by sedative and alkaline medicines, regardless whether they were caused by prostatic affection, stone, or any other local disturbance. The use of the sound was deferred: that could be used at any time: and, usually, it was first introduced into the bladder when the patient's sufferings had become severe and protracted. He knew that the patient would not easily be brought to submit to the knife; and that to ascertain the existence of the stone in the early stage of the disease was a matter of no great moment. The operation of sounding was also conducted in a slovenly manner. If the stone were not discovered when small, it would be when large; and no advantage was gained by operating in the early stage. Now, the surgeon examines the bladder with great care: knowing the importance of discovering the calculus at the earliest period, he no longer leaves its existence a matter of doubt, but proceeds at once to examine the bladder, and determines its presence; or, by a skilful searching of every part of the viscus, ascertains that a stone does not exist. In the present state of the art, a surgeon would be highly culpable who did not decide, by the sound, whether the symptoms for which he was consulted arose from calculus, or from some other cause.

The early symptoms of the disease are thus watched with more jealousy on the part of the surgeon, and are not so scrupulously concealed by the patient. The advantages of an early knowledge of the existence of a stone, and of prompt measures for its removal, are known to both. The result of this is, that patients apply for advice when the stone is small, the bladder uninjured by its presence, and the kidneys free from disease. In three persons out of four who apply for advice for symptoms of calculus, the size of the stone and the conditions of the viscus render lithotrity an easy and a safe operation. Within the last three or four years, I have remarked the very early application that patients make for advice, and the small size of the stone when first discovered, compared with those of former years. In private practice, I have not extracted, by either operation, a calculus larger than a good-sized mulberry; except

in three cases, in one of which the stone was of unusually rapid formation. It rarely acquires any considerable size before the symptoms of its presence become sufficiently urgent to induce the patient to seek for assistance: often, when it is so small as to be with difficulty discovered, it causes extreme pain after the expulsion of the urine; and it will not often be found to exceed a hazel-nut when first the surgeon is consulted. Hence lithotrity will become even more employed, as it is made more generally known.

The advantages of lithotrity cannot be sufficiently or truly estimated, without instituting a fair examination of the dangers respectively attending the two operations. I shall first review those that are incidental to lithotomy; and endeavour to determine how far the new operation enables us to avoid them, without presenting in their place others of an equally grave character.

There is no age at which lithotomy is impracticable. From the infant to the most aged, stones may be removed, by the lateral operation, with perfect ease and security. At the age which is peculiarly unfitted for lithotrity the knife may be employed with comparatively little danger. It is difficult to mention any operation in surgery so uniformly successful as lithotomy is in children. The incomplete development, and the consequently little susceptibility of the parts involved—the small size of the vessels, and the little risk of hæmorrhage—the yielding nature of the textures, rendering force unnecessary in the extraction of the stone—are circumstances that combine, to divest the operation of much of the danger that surrounds it, when performed on the adult. It is a rare occurrence to lose a young patient when the constitution of the child is favourable. The sister of one of the female wards told me, that she had never lost a patient after lithotomy, and had had more than thirty do well*. Much irritation in the system does not appear to be produced, even during the period of dentition, when surgical operations in general are accounted

* The ward alluded to (Charity) is one, among other female wards, into which boys under eight years of age are admitted: the patients with stone not being confined to one ward.

hazardous. I have cut a child for stone at the early age of sixteen months; and have assisted at an operation when the patient had only completed its thirteenth month. The removal of a source of irritation to the constitution may explain the little irritative effect that follows lithotomy in children. Though these young subjects are happily not liable to infiltration of urine into the cellular membrane, or to peritonitis, they are exposed to another source of danger, from sudden prostration, under which their powers will sometimes sink. This depression occurs in those children whose parents accustom them, even at their tender age, to the pernicious habit of dram-drinking; a custom partly arising from the erroneous idea, that gin, by increasing the urinary secretion, tends to allay the irritation produced by the stone. Such children, when brought into the hospital, being subjected to the lowering effects of a milder and restricted diet, and to the action of brisk purgative medicines, are rendered irritable and susceptible, and can ill bear an operation that exhausts their energy, and is attended with some loss of blood. A small dose of syrup of poppies, with a tea-spoonful of gin, or whatever liquor they may have been accustomed to, soon restores the tone of the nerves and the vigour of the circulating system. After the operation is concluded, there is little suffering for the child to endure: the wound requiring no dressing, and no painful examination, the little patient proceeds, undisturbed, to complete convalescence. Another advantage which the child enjoys, is, the absence of mental anticipation—a state of mind that perhaps constitutes half the sufferings felt at any operation, and may tend to increase the danger. The freedom from such anticipation in the child diminishes the actual danger, and also exempts its feelings from half the horrors which the man cannot but feel. Seeing, then, that so little risk and suffering attends lithotomy in children, it is difficult for us to find an equally safe and efficient substitute: it can scarcely, indeed, be said to be required.

From childhood to the age of puberty the dangers attending lithotomy can hardly be said to increase. Boys of thirteen years of age suffer scarcely more from the operation than children, and for the same reasons: but after

puberty, the risk begins to be greater. The development which the parts about the neck of the bladder acquire increases the volume of the structures opposed to the knife: the incision is therefore necessarily larger; and thus the number of vessels divided is also increased. These vessels are not only of larger size than in the child, but they are relatively of larger calibre. The stimulus given to the circulation, and the additional and rapid growth of the organs at puberty, are attended by a corresponding enlargement of the pudic artery and its branches; which offers one, and perhaps the principal, source of danger which the operator has to encounter in the adult.

It is not ingenuous for lithotomists to deny the occurrence or the danger of hæmorrhage. It is unquestionably most formidable when it does occur; and I apprehend that few surgeons who have seen much of lithotomy have not occasionally witnessed a loss of blood larger than the patient could well bear, and which has had an indirect effect on the result of the operation. It is rare for patients to die immediately from loss of blood. The arteries are not large enough to afford a hæmorrhage sufficiently rapid to induce fatal syncope; but the draining sometimes continues for hours; either backward, into the bladder; or slowly, by the external wound; gradually exhausting the patient, and incapacitating him for the struggle which he may have to undergo with visceral disease or inflammation. It is this secondary effect that constitutes the chief danger of bleeding after lithotomy, and usually takes place in patients who have slight enlargement of the heart and a large arterial system. The pulse is found to be full and large, even when the patient appears exhausted by the loss of blood: the lungs become gorged, and, under the depressed state of the nervous energy, become embarrassed in their circulation. The heart, thus encumbered by the difficult pulmonary circulation, relieves itself by serous effusion into the pericardium, and death speedily ensues. If inflammation come on, either in the peritoneum or the vesical cellular tissue, the prostrated powers of the patient disable him from setting up a barrier to the mischief by a salutary adhesive process: in the latter case, the action assumes the suppura-

tive form, and cellular abscess is the fatal consequence; and in the former, a slight extension of the peritonitis, producing opaque serous effusion, is sufficient to induce fatal prostration.

I may, perhaps, over estimate the ill effects of loss of blood, on the issue of surgical operations. It is from frequent observation of its effects in the larger operations that I have formed my opinion. I cannot understand the good which a free hæmorrhage is supposed by some to do, in the prevention of inflammation. Enough blood is lost at every operation, be the surgeon ever so careful, to unload a distended state of vessels, and to diminish the chance of excessive action. Beyond this, all that is lost tends but to increase the irritability of the patient, and to deprive nature of her powers. It is far better to lower the patient's system, should it be plethoric, by a well-regulated system of diet, not to the extent of inducing irritability, but to the point of preventing superabundant nutrition. It is very rarely that I bleed a patient before an operation, even when it is one that is attended with very little loss of blood. I prefer preparing him by diet; and defer taking blood from the arm, till symptoms of approaching inflammation demand it. There is a class of persons who are said to be benefited by taking away a pound of blood before the operation: these are, the hale and healthy men. These persons, it is true, are not rendered irritable, and appear none the worse for the loss; but such persons are not disposed to unhealthy inflammation, and the bleeding is altogether unnecessary. I have notes of many cases of disease, of accident, and of operation, attended by a large loss of blood, which have been followed by inflammation, slight, but sufficient to destroy the already-exhausted patient.

There are several sources that furnish the hæmorrhage; but, in all cases, the bleeding comes most freely from the upper angle of the wound. The higher therefore the incision is carried, the greater, *cæteris paribus*, is the probability of bleeding. The pudic trunk itself is, I apprehend, rarely wounded. The artery of the bulb, and the superficial perineal branch, often bleed profusely, especially the former. This vessel, traversing the upper angle of the incision, is

generally divided; and its great variety in size, in different persons, and on the two sides of the same individual, renders the quantity of blood from this artery so variable. If the incision be carried very low down in the perineum, it may escape altogether; but it is not easy to cut below it. I have tried several times to perform the operation, on the dead subject, below the artery of the bulb; and though I could generally avoid it, by keeping the incision low, I believe it is almost always divided. The end of the vessel entering the bulb is often seen to bleed profusely, while its other extremity is closed; and pressure on the pudic artery does not restrain it. Indeed, hæmorrhage after lithotomy often continues, notwithstanding pressure may be made on the pudic trunk. I am averse to the practice, adopted by some surgeons, of plugging the wound with lint or sponge introduced on a catheter. The cellular membrane is irritated by it, and an unhealthy form of inflammation ensues; while, the catheter, being soon blocked with coagulum, does not carry off the urine from the bladder. I have, however, found advantage in checking the bleeding by means of pressure, made upon the upper part of the left side of the perineum by a forked pad of lint fixed to a piece of cork. Pressure in this mode also reaches the deeper branches of the prostate, from which the blood sometimes oozes for a long time after the patient is placed in bed, and distends the bladder with masses of coagula. The accident of hæmorrhage is further increased by occasional varieties in the distribution of the branches of the pudic artery;—a remarkable instance of which was published by the late Mr. Shaw, and has been further illustrated in Mr. Stanley's work.

Infiltration of the cellular membrane with urine, as it escapes from the bladder, is another danger which the lithotomist has to dread. This, in some degree, is dependant on the manner in which the operation is performed, and partly on the constitution of the patient. It occurs more frequently in the adult than in the young subject. Most generally, it is the consequence of violence done to the deep perineal fascia, which sloughs or ulcerates, and allows the urine to escape backward, in the reticular tissue surrounding the neck of the bladder. I have, however, known the infiltration to

ensue, when the stone being small, the incision in the prostate gland was limited, and no force was employed in the extraction of the calculus. In such cases, the constitution of the patient is in fault: an unhealthy form of inflammation attacks the cellular membrane and fascia, which breaks down and destroys the barrier that nature opposes to infiltration. The sloughing also extends to the superficial wound, and to the incision of the prostate; the inflammation induced by the incision partaking of the asthenic irritability of the patient's system. A more frequent cause of infiltration is, the violence committed in dragging the stone through the incision in the gland.

Setting aside hæmorrhage, the injury inflicted on the neck of the bladder and prostate gland gives rise to the most formidable danger that attends lithotomy. In this respect it resembles lithotrity; for in both operations it is the violence done to the neck of the bladder that destroys the patient, in the majority of fatal cases. It is the manner in which the injury is inflicted that constitutes the danger. If we may judge from experience, the prostate gland would appear to sustain without inconvenience the effect of laceration: and this the experienced lithotomist bears in mind, in the act of extracting the stone. But contusion is most disastrous in its effects: it appears to cause sloughing, and diffuse inflammation of a destructive character in the neighbouring structures. In making the incision, and in extracting the stone, the object of the operator should be, to make a sufficient aperture to allow the stone to pass without bruising the gland; and not to carry the knife too far laterally, so as to divide the deep perineal fascia, and thus expose the cellular basin of the pelvis. The knife, if used incautiously, exposes the patient to this danger. If the prostate be large, and the stone of considerable size, a large aperture is required; and if the substance of the gland be indurated, the lips of the incision do not yield. To obviate these inconveniences, the surgeon carries the knife more freely through the prostate, and thus adds to the risk of opening the deep fascia that of hæmorrhage from the arteries of the gland. Under these circumstances, I always look to the assistance which the blunt gorget affords, as

obviating both the difficulties, without inflicting an injury of a serious kind upon the gland. This instrument, in the hands of the late Mr. Martineau, has had its merits fully tried; and its success is sufficient answer to any objection that can be urged against it. His object, in this part of the operation, was three-fold—to make a small incision in the gland with the knife; to enlarge the incision with the blade of the blunt gorget; and to take time in drawing the stone from the bladder. In so conducting the operation, the gland is not bruised, but torn: the slow introduction of the blunt gorget separates the fibres of the gland, and enlarges the incision as far as the deep fascia, without dividing it; for the fascia yields, and stretches, as the gorget enters the bladder. Sudden violence, in the act of introducing the gorget, is nearly as much to be deprecated as the violent extraction of the stone. The kind of violence which the blunt gorget, properly employed, inflicts, is well borne by the gland, and symptoms of high inflammation are rare, after such an operation.

The extraction of the stone is attended with more hazard to the gland. A nervous or a violent operator, feeling some resistance to his efforts, redoubles them, until he finds the stone obeying the force that he employs. If the opening in the gland be made with a cutting instrument alone, and be small, the stone is brought with difficulty into the incision, as the lips of the wound do not open. Additional force is then employed; and the operator, in ignorance of what he is doing, drags the gland before the stone, separates it from its attachment to the deep fascia, and brings it nearly to the external aperture before his efforts succeed. The consequence of such an injudicious proceeding is, to bruise the gland, to cause it to slough, and to render infiltration of urine almost inevitable, by the laceration of the deep prostatic connexions. The danger is, in part, prevented by the use of a broad blunt gorget, which enables the broad end of a large stone to enter the incision; and renders it obedient to the gentle but continued force of the surgeon. In this step of the operation, time must be given for the parts that embrace the stone to dilate: the muscular structure at the neck of the bladder, the firm substance of the prostate gland,

and the deep fascia, will each stretch, and yield to the sustained efforts of a firm but gentle hand. In cases of enlarged and hard prostate, I have occasionally opened the incision while passing the forceps through the prostate, by separating the blades in a vertical direction: this, however, should be done without violence.

The gland is sometimes injured in withdrawing the stone, by the forceps embracing a portion of it, and tearing it away from the body. This accident happens when the central portion of the gland, or, as it is termed, the third lobe, is enlarged, and presents a narrow ridge at the entrance of the bladder. The forceps, where the blades diverge, close on this projection, as they embrace the stone; and the operator is unaware of it, until a piece of the gland is brought away in the blades. It may be avoided, by passing the finger below the forceps, and disengaging the gland from the forceps after the stone is seized*. In my operations, I always pass the left fore-finger along the staff, after the knife is withdrawn; and reconnoitre the size of the incision, the texture and form of the gland, and situation of the stone. If the finger feels a projecting portion of gland that rises between the blades of the forceps as they are opened laterally, care should be taken to prevent it being entangled, by depressing it as the stone is brought forward. As soon as the stone enters the incision, the danger is past. I do not, however, wish to magnify the extent of this danger; for, in truth, it is less than might be expected. The injured portion is brought away, and not left to slough; and the surface from which it is brought is a lacerated wound, without contusion. In one case, that of an elderly gentleman, it happened to myself in operating; but the patient, after suffering for a few days with irritative fever, ultimately did well: and I have observed, in the few

* Since the year 1823, when I published an account of the operation with the straight staff and knife, I have invariably employed them in every operation, both in hospital and private practice; and have never met with any difficulty in the deepest perineum or the most enlarged prostate gland. My colleagues, Mr. Morgan and Mr. Cooper, also employ them in their operations of lithotomy. The experience that I have had confirms the opinion that I then expressed, that they are more manageable instruments than those ordinarily used in the operation.

cases that have occurred in the operations of other surgeons, that a slight degree only of fever, with fetid urine, has been the consequence, and in a few days has passed away. The neck of the bladder becomes slightly inflamed; but the incision prevents the ordinary severe effects of cystitis, by allowing the urine to drain away—an advantage that lithotrity does not possess.

The body of the prostate may receive injury from being grasped in the forceps, by the operator expanding the blades before they are fairly in the bladder. One blade slips beneath the lobe, while the other enters the bladder; and the operator, on closing them, thinking that they embrace the stone, uses considerable force in his attempt to extract it. The contusion and pressure which the gland undergoes are sufficient to induce inflammation, and, probably, some of its worst consequences.

In many, or perhaps most, of the fatal cases of lithotomy, inflammation of the peritoneum, investing the fundus of the bladder, is found to exist to a greater or less extent. In some few cases, it is of sufficient intensity to cause the destruction of life; but even where the mischief about the neck of the bladder is evidently of itself the cause of death, the peritoneum often partakes of the morbid action. This disposition of the peritoneum to participate in the inflammation of the perineal structure is not confined to the operation of lithotomy, but manifests itself in other operations on the perineum. In the opening of the membranous part of the urethra for stricture, where the cellular membrane and muscles of the perineum are divided, it is not uncommon to find the patient labouring, in a few days, under a sharp attack of peritonitis; and, in some instances, under a fatal form of the disease. The action appears to be propagated by the cellular membrane of the perineum to the peritoneum. On examination after death, the continuity of the inflammation, or at least its effects, cannot be discovered in the reticular tissue; but the most probable explanation of the frequent connexion between the morbid states of the two parts is the continuity of action. This is one source of danger to which the wound in the perineum exposes the patient.

Lithotomy is altogether free from the risk of leaving fragments in the bladder, where ordinary care is taken to examine the cavity, and to wash out whatever fragments may have been occasioned by the accidental breaking of the stone. If a fragment or two remain behind, they usually pass through the wound by the fourth day, when the tumefaction occasioned by the incision has subsided; and clots of blood are rarely retained for any length of time. These often collect in the bladder, through the oozing from the prostatic vessels; but occasion sufficient irritation to induce the bladder to expel them. The patient may be rendered very uneasy after the operation, by a sense of distension in the region of the bladder, and of bearing down in the perineum; which continues until the repeated efforts of the bladder expel some small masses of coagula: or, if the distress be great soon after the patient is put to bed, and continues toward the evening, it is often found to arise from coagula obstructing the flow of urine; and the gentle introduction of the finger along the wound is followed by a copious discharge of urine mixed with coagula.

I will not omit the danger attending a wound of the rectum, though I cannot attach much importance to it. It appears to me, that undue importance is given to the accident. It is a very rare occurrence, so far as my experience extends. Among all the operations that I have witnessed, I have only once known the rectum to be wounded, and then without the supervention of any untoward circumstance. It occurs usually, I apprehend, in making the second deep incision, in reaching the groove of the staff; or in dilating this incision after the groove is exposed. In doing this, the operator carries his knife more freely downwards, to divide the transverse muscles of the perineum and the fascia that reaches to the levator ani; and if the rectum be distended with air or feces, the knife may easily open it. When other sources of danger and irritation exist, such an additional evil adds to the aggregate of the danger; but, taken by itself, the wound of the bowel, occurring as it does close to the sphincter, is a matter of no serious moment.

The after-consequences of the operation of an untoward kind may be summed up in the accidents of fistula in

perinaeo, impotency, and incontinence of urine. The first I have not witnessed as a consequence of the operation for vesical calculus. The operation of extracting prostatic calculi, when they are large and the gland diseased, is sometimes followed by difficulty in healing the external incision; and the formation of a fistula, through which some drops of urine escape. But in lithotomy, the incision, being made through healthy structures, heals quickly, by a healthy process of granulation; and fistula is, therefore, a very uncommon occurrence. In a gentleman verging upon eighty years of age, whom I cut about three years since, an abscess formed in the prostate gland, and burst into the rectum. Benefit, rather than inconvenience, followed this; for the prostate, being very much enlarged, had obstructed the free escape of urine from the bladder, and partial retention often occurred: the aperture into the rectum remedied the difficulty, by allowing the bladder to empty itself more completely; and was otherwise of little inconvenience to him. The external wound healed in the usual manner. Impotency I have known to occur, in one instance: at least, it was attributed to the operation by the patient, who was otherwise a healthy person. Incontinence of urine rarely occurs in the adult, according to my experience. In the young subject, partial incontinence will sometimes occur, if the patient is allowed to leave his bed too soon after the operation, before the neck of the bladder is firmly healed, and the sphincter has recovered its tone. Instances, therefore, are met with, of young boys, who, if they retain their water inconveniently long, find it dribble away as they move about. In bed, the urine is perfectly retained. When they arrive at the age of puberty, the power of retaining it becomes increased.

The preceding sketch will serve to bring before the surgeon the several difficulties which surround lithotomy; and to remind him, that although, in the hands of English surgeons, it is a most successful operation, it nevertheless has dangers, for which he cannot be wholly prepared, and against which he cannot with certainty guard. Were it

possible to foresee the occurrence of hæmorrhage, and its effects on the constitution of the individual—and, when it does occur, to arrest it with ease and certainty—the operation would be divested of one half of its risk. Or, if the causes of inflammation could be seen and warded off by any previous management, and all constitutional infirmity remedied, the lithotomist would have little to fear. But no experience, however great, can enable us to foresee the perils that suddenly arise, in the midst of apparent security. Judicious preparation of the patient, by regimen and medicine, may diminish his sensibility, and disposition to inflammation; but the unexpected results of cases teach us, that there are unknown causes in operation that prostrate the patient's powers, even when he appears to be in the most favourable state for the operation, and the utmost skill is employed in the performance of it. In the knowledge that we have of coming danger, the balance is much on the side of lithotrity.

In the observations that I shall make on lithotrity, I shall consider the circumstances that render it practicable, the mode of performing it, and the dangers attending it: and having described the several steps of the operation, I shall endeavour to lay down some rules to assist in determining which operation is more eligible, in each particular case.

To the discovery of the calculus in its earliest stage, I have already adverted, as one of the greatest benefits conferred by lithotrity; and the very first intimation of the presence of a stone in the bladder should not be neglected. The symptoms of its existence are too well known, and have been too often described, to require a repetition of them here. The previous occurrence of a nephritic attack, and the descent of a stone through the ureter, should lead us to look for some vesical symptoms occasioned by the attempt of a small calculus to enter the urethra. A stone, when it has descended into the bladder, is usually of very small size, and causes scarcely any noticeable sensation in the act of micturition: it often lies quiet in the base of the bladder for some weeks, until, by its continued presence, irritation is

produced, and forcible and repeated efforts to expel it are made after each evacuation of the urine. The pain which the patient suffers results not so much from the contraction of the viscus on the stone, as from the force with which it is pushed towards the orifice of the urethra, and the consequent spasmodic action of the muscle at the cervix. Sometimes the stone becomes partly impacted in the orifice of the urethra, and gives the patient excruciating pain, until the contraction of the bladder ceases, and the stone again falls back into its cavity. The sufferings in this way occasioned by a very small calculus are often greater than when the stone is larger, until inflammation arises at the neck of the bladder, and then the pain becomes much aggravated. A stone, when it first begins to occasion symptoms, is usually not larger than a small horse-bean; and the smallness of its size often occasions it to elude an examination of the bladder, imperfectly or hastily conducted.

The operation of sounding has been rendered much more exact by the assistance afforded by Heurteloup's bed. Had this expert lithotritist contributed nothing else to the operation, lithotrity would be greatly indebted to him. The certainty with which the presence of a stone may be ascertained, be it ever so small, will not fail to strike a surgeon accustomed to the former inexact method of sounding. A common sound introduced into the bladder of an adult with a full-sized prostate gland can with difficulty be brought in contact with a small stone lying in the hollow of the bladder behind the gland, especially if there be a few ounces of water collected in the cavity. The convex part of the beak cannot, by any ingenuity, be so turned or moved in the bladder as to reach it; and the patient is pronounced to have not a stone, until it increases in size, and acquires magnitude sufficient to meet the sound. The important period is thus lost; one seizure of a stone so small would be sufficient to crush it; but the imperfect manner of conducting the examination, in too many instances, leads the surgeon to form an erroneous opinion. These difficulties are wholly obviated by the lithotritic bed; which, in addition to its utility in the operation of crushing the stone, enables us to detect its presence in the earliest stage, and even to ascer-

tain its size with a great degree of precision. For the purpose of examination, the bladder should be neither quite empty, nor should it contain a large quantity of water. The former state is, of the two, the less objectionable; for the stone is sometimes met with at the entrance of the bladder, when the latter is empty; and its presence is at once recognised by a sharp tap against it, as the sound enters the bladder. But it is more desirable to have a small quantity of water in the bladder, as the stone can be both felt and examined as to its physical qualities. The inconvenience of a large quantity of water may be experienced in the following manner. If the patient lie on a sofa, and about two ounces of water be injected through the catheter, the stone will generally be felt at the lower part of the bladder, and its size and depth may often be pretty accurately ascertained: if two or three more ounces of water be injected, the stone sinks down into the base of the bladder, and its upper surface can alone be felt, and that imperfectly: if the quantity of water be increased by a further injection of three or four ounces more, the stone sinks wholly below the level of the instrument, and altogether eludes it. This arises from the peculiar manner in which the bladder dilates, as water accumulates in its cavity; of which I shall have occasion to speak more particularly. The operator may think, that the more water the bladder is made to contain, the more easy will be his examination; the motion of the instrument being more free in a large than in a small cavity. The quantity of water should, indeed, be sufficient to allow the short beak of the catheter to move freely, in a lateral direction: about three ounces will be sufficient in an ordinary bladder; but, in order to make the examination more satisfactory, the stone should be dislodged from behind the prostate, by suddenly inclining the patient backward, and altering the axis of the bladder: this is effected by the couch or chair*.

* For a minute description of the anatomical bearings of the bladder, I refer the reader to the work on Lithotrity by Baron Heurteloup, and to Mr. King's Comparative View of Lithotrity and Lithotomy: my object in this Paper being rather to confine myself to the more important points connected with the operation.

The chair (fig. 9) which I use for this purpose is constructed on the principle of Heurteloup's "lit rectangle." It is made in the form of a common couch; with the back inclined, at an angle of 45° . The position of the hind legs enables the whole to be inclined backwards by a very gentle force applied at the end to which the vice is fixed: the force of one hand is sufficient to raise it, even with the additional weight of the patient, as the two extremities of the chair are nearly in equilibrio when the fore-part is somewhat raised. By these means the operator is enabled to dispense with an assistant, at least in sounding; as he can, after introducing the catheter with one hand, throw the patient back with the other. The shock communicated to the stone in the patient's bladder can be increased at pleasure; but, in sounding, not much jar is required to dislodge it: the sudden change of position alone is sufficient to make it fall into the back part of the base; where it is readily felt, by carrying the catheter at once backward, and raising the handle nearly as much as the cervix vesicæ will permit. In dislodging fragments, the chair is especially serviceable. The force with which the end can be thrown back on the floor will detach any fragments that may couch behind the base of the prostate. Besides being admirably adapted to the purpose for which it is principally intended, it is found useful for other surgical purposes in which a sofa may be required. To the lithotritist, such a chair or bed is indispensable: by its aid, he is enabled to discover the calculus more readily, to remove the fragments with more certainty, and to break the stone with more safety and less suffering to the patient.

The sensation which a stone communicates cannot well be mistaken. The sense of touch alone is generally sufficient to decide the presence of a calculus: if there exist a doubt, the ear should be appealed to; and the operator should not be satisfied till he has heard as well as felt the contact between the metallic instrument and the stone. The touch may sometimes mislead, when there is a fungus in the bladder, or a portion of the mucous coat morbidly thickened; in both which cases the symptoms closely resemble those of stone in the bladder. But, in these forms of

disease, the ear cannot deceive the surgeon; and the absence of sound, when the foreign body is struck, is sufficient to decide against the existence of calculus. I have found sometimes, when the friction of the sound over the foreign substance has been equivocal, that the injection of oil into the bladder has removed the deceptive sensation which the contact of metal with a fungoid mass surrounded by water will produce. An instance occurred not long since, of a bleeding fungus being mistaken for a calculus. The patient was sounded more than once, by an experienced surgeon, and pronounced to have stone: he was placed under the care of a lithotritist, who fixed a day for the operation. The patient, however, became so ill, before the day arrived, that it was necessary to defer the operation. On his death, which took place in a few days afterwards, no stone was discovered in the bladder; but a bleeding fungus, of considerable size, was found attached to the mucous membrane. The occurrence of a cyst enveloping the stone in the bladder is often held out as likely to mislead the surgeon, and to prevent that satisfactory evidence being obtained that a careful operator would wish to have before proceeding to the operation. The occasional presence of a cyst around a calculus cannot be denied. In a case on which Mr. W. Wickham operated, a something was removed with the stone that resembled a cyst formed by adhesive matter: it was so thin, as not to prevent a distinct sensation being communicated by the sound. Such cases are very rare. The stone may also be lodged in a sac formed by a protrusion of the mucous coat between the muscular fibres of the bladder. Such a variation in the position of the stone is seen sometimes. We have a specimen of it in the Museum; but, like the former, it is a very unusual variety in the situation of a vesical calculus. I have never met with such accidents, either in hospital or private practice; nor have I witnessed them in that of my colleagues.

The instruments that are used for the discovery of a calculus are two—the steel sound, and the silver catheter. Each has its advantages. The latter has become the more general instrument, since the introduction of lithotrity, on account of its combining the office of the sound with that of

injecting the bladder. The best form is that of Heurteloup's catheter: the shortness of its beak enables the surgeon to examine the bladder in all its parts; to reach even its deepest recesses behind an enlarged prostate gland; and to measure, with some degree of certainty, the depth and form of the stone. The beak can be turned in all directions, so as to sweep the lateral parts of the base, as well as the most depending part of the cavity. The sensation, however, conveyed by the hollow silver tube is less distinct than that communicated by a solid steel instrument; and I have known instances where a sound or sensation of an equivocal character has been transmitted by the tube, and where all doubt has been removed by the more accurate impression given by the contact of the sound. Another disadvantage of the catheter is, the alteration that it produces in the course of the canal, by raising the prostate gland. This will be understood by contrasting the straight tube of the catheter with the curve of the sound. When the former is in the bladder, the part of it that lies in the prostatic portion of the urethra is a straight line; and when the hand is depressed, the prostatic portion is necessarily raised, and the *cul de sac* of the bladder anterior to the ureters is deepened. A small stone, or fragments, may then escape the touch of the catheter, unless they can be thrown backward into the base of the bladder. The common steel sound is free from this disadvantage: when the beak is in the bladder, its curved portion is in the prostate gland, and causes no distortion in that part of the canal; so that, as it enters the bladder, a small stone may be struck, over which the silver catheter would pass without touching it. If the bladder contains about an ounce of urine, which is sufficient to allow the sound to enter freely, the stone, however small, rarely eludes it. In the examination of persons suspected to be afflicted with calculus, I usually first employ the catheter, after injecting two or three ounces of warm water, and reclining the chair: and if I do not strike a stone, or if I meet with a something, of the nature of which the silver tube fails accurately to inform me, I then allow some of the water to escape, and introduce a common steel instrument. In this way, the most exact information may be obtained of the presence of

a foreign body: its size and form, as well as the existence of more than one, can be best ascertained by the catheter; but the sound and vibration are best communicated, in doubtful cases of small stones or fragments, by the solid steel instrument.

The size of the calculus forms of itself no objection to lithotrity. A large stone presents, however, several considerations for the surgeon to weigh, before he undertakes the operation. As the stone cannot be entirely crushed at one sitting, a patient with an irritable or an unsound bladder becomes involved in most serious danger by the operation being hastily adopted. A large stone broken up into many irregular fragments, all crowded by the contractions of the bladder against the irritable and inflamed cervix, causes excessive efforts to void the urine, and even inflammation of the mucons surface. Under such circumstances, the repetition of the operation becomes impossible, or highly dangerous; and the patient has to struggle through the stages of inflammation, with a bladder irritated by the lesser fragments. But if the bladder be free from disease, and not very irritable, it will bear the number of sittings required to break up a large stone, without much suffering to the patient, and with very little danger. The success of lithotrity, like that of most surgical operations, mainly depends on its subject. If the constitution be good, and the power of endurance great, difficulties of most unpromising nature may be overcome. We should therefore pay more regard to the general condition of the patient, and of his bladder, than to the size of the stone; and inquire minutely into the several circumstances likely to have an influence on the result of the operation.

One of the earliest cases in which I operated was that of a Mr. T—, of unhealthy constitution, much worn down by his continued sufferings, and by calculous affection of the kidneys. The stone was so large, that, taken with other circumstances, it induced a very experienced surgeon to give an opinion adverse to lithotrity. The patient's decided objection to lithotomy, however, left me no alternative; and by proceeding with caution, I broke up the stone, after not fewer than sixteen sittings. The irritability of his bladder decreased,

as the stone became diminished in volume and the fragments expelled. I know of no limits to the size of a calculus removable by lithotrity, but the power of the lithotrite. If a powerful instrument can be brought to embrace it, and the organ be healthy, the operation may, as far as my experience goes, be attempted with propriety*.

The different ages of patients to be submitted to the lithotrite or the knife are remarkably contrasted with one another. Whilst to youth and advanced age the latter is more suitable, the former is found to be generally better adapted to the middle period between puberty and the decline of life. We have seen, in speaking of lithotomy, that persons whose sexual organs are completely developed, are more liable to the accidents attending the use of the knife, than children whose organs are not yet evolved; or than the aged, whose irritability is on the wane. The full-grown healthy adult, on the contrary, presents all the conditions most favourable for crushing the calculus. The canal is sufficiently large to admit an instrument efficient from its size: the prostate gland also is usually healthy, and free from the enlargement of age; thus rendering the neck of the bladder, a part so important in the operation, little exposed to the dangers of inflammation. When there is a normal prostate gland, the operator may manipulate his instrument without risk of bruising or otherwise injuring this most sensitive of all the parts concerned in the operation. The urethra of such patients being more free, the fragments are expelled with less difficulty; and cause less pain in their expulsion, which is also materially assisted by a sound and vigorous bladder. At this age, also, inflammation, should it supervene, is more easily controlled than in the aged subject, who cannot well bear depletion. The warm bath and free venesection speedily arrest the inflammation of the mucous membrane of the bladder; but the old are soon depressed by the diseased action, as well as by the measures required for its suppression. Inflammation, however, is less likely to occur in such healthy subjects, where the parts are not mechanically injured by the operation, and when the patient has

* Mr. Costello has broken up a calculus weighing several ounces.

been prepared by dietetic and other prudential measures. The aged subject, however, is not less adapted to the operation than the younger adults, if he be free from the common accidents of age—as an enlarged prostate, accompanied with an irritable state of bladder. If the parts in the aged are sound, the operation is especially successful in them; as there is less irritability in the organs of generation, and less excitability of the general system. The urethra, also, is usually larger; and if the neck of the bladder be free, it allows fragments of extraordinary size to pass. I have in my possession a piece of calculus passed by an elderly gentleman, $8\frac{1}{2}$ lines in length, and $4\frac{1}{2}$ across: it is a piece of phosphatic calculus, broken off by the first application of the percussor, and rendered smooth at its angles and edges by undergoing attrition in the bladder for three weeks. It even passed without difficulty or pain. In the old subject, however, difficulties often present themselves in consequence of the change which the parts about the neck of the bladder undergo, and the unsound condition of the bladder itself consequent on these changes. The operation in such persons is rendered dangerous by the inflammatory disposition of the organ, and by the difficulty with which the fragments make their way through the prostatic portion of the canal.

The state of the bladder is perhaps, of all the circumstances that the lithotritist has to consider, the most important; and one on which the propriety of performing the operation will mainly hinge. Three conditions of this organ are necessary; and these must be ascertained, by preliminary observations and trials, before the operation is determined on:—1st, It must be capable of holding a sufficient quantity of water to facilitate the working of the percussor. 2dly, It must be free from that extreme irritability that often attends the latter stages of calculous disorders: and, 3dly, Not prone to inflammation, from slight excitement. In healthy persons, the bladder, even under the irritation of a stone, will allow several ounces of water to be injected into its cavity, without sustaining more than a slight inclination to eject it. Its retentive powers are not impaired in the early stages of the disorder: patients will go for many hours without any desire to empty the bladder, the only

early symptom being a smarting, when the bladder contracts on the calculus. It is therefore rare to meet with any difficulty in injecting water sufficient for the purpose of giving space for the operation, among those who apply for advice soon after the symptoms have begun to declare themselves.

Even when, from the long-continued presence of the stone, the bladder becomes morbidly affected, and able to contain but three or four ounces of urine without an irresistible desire to expel it, much may be done, by treatment, to assuage the irritation of the mucous membrane, and tranquillize the muscular excitability. When the stone has been long resident in the bladder, and has produced a change in the mucous membrane and a copious discharge of phosphatic mucus, signs of extreme irritability come on, and almost seem to forbid any expectation of lithotrity being practicable. The desire to void urine is renewed every two hours, or oftener: the urine not only deposits a large quantity of dark-coloured mucus, but is cloudy, and loaded with small flakes of adhesive matter, the result of inflammation of the mucous lining: the pain in expelling the last few drops of mucus is intense. Such continued suffering at length affects the general health; and would seem, I say, to forbid the operation altogether. Frequently, however, will these formidable symptoms yield to a system of diet and medicine, and the patient by degrees be unexpectedly brought into a condition to bear the operation. Two summers ago, I was consulted by a gentleman who for more than three years had experienced symptoms of stone in the bladder; which had of late increased so much, as nearly to confine him to the house. I sounded him, and discovered a stone grasped closely by a very irritable and tender bladder. On injecting, or rather attempting to inject, a small quantity of water, he complained of excessive pain from the slightest pressure on the piston of the syringe; and I endeavoured in vain to overcome the resistance of the bladder. His urine was high-coloured, and loaded with a copious secretion of a dark bloody mucus: his pulse was quick, and tongue furred. The slight examination that I made of his bladder was followed by severe rigors and fever, which

remained upon him for several days. So untoward a case appeared to hold out but little prospect of being benefited by lithotrity. He was ordered to employ a mild form of diet, to abstain from all fermented liquors, and to take saline medicines, with the alkali predominating. In three months, his symptoms had so far improved, and the irritability of the bladder was so much diminished, that I crushed four calculi with very little disturbance of his system, and with decided amelioration of his vesical irritation. Instead of the mucous secretion being increased by the operation, or the desire to void urine becoming more frequent, both these symptoms were relieved; and the fragments of lithic acid were entirely discharged from the bladder, with as little irritation as I ever witnessed after an operation. An opinion cannot be formed of the real condition of the bladder by one sounding, or once injecting the bladder. Those who have irritable bladders usually experience some form of irritation, after moderate distension with water, and examination with the catheter. It generally assumes the form of rigor, occurring once or more in the twenty-four hours after the examination has been made, and followed by severe pyrexia, that lasts for several days. The rigor of itself indicates the degree of irritation produced by the sound; and if not followed by the hot stage of fever, it indicates nothing more: but the presence of pyrexia is evidence of inflammation taking place; and such a state is most unfavourable to lithotrity. A distinction, therefore, is to be drawn between these two states: the occurrence of a rigor need not deter the surgeon from commencing the operation—it often attends the first examination, and may never recur; but the indication of inflammation, drawn from a continued state of pyrexia, should at once induce him to defer the operation, until, by withdrawing all stimuli, he has brought the bladder into a tranquil state. This disposition to inflammation is often kept up by improper food, especially drink; and is indicated by a plethoric condition of the system, and a flushed countenance. Such a condition may be overcome; and is unlike that state of bladder which is the effect of commencing disorganization, and often associated with diseased kidneys. This state of organs is also attended by

the same degree of irritability, the same bloody mucous deposit after sounding, and the same accompanying fever: but the constitution presents not the healthy aspect of temporary excitement; there is generally more pallor of countenance, amounting to a pasty state of the skin, with an occasional streak or patch of colour.

A gentleman with symptoms of stone came to town, to place himself under my care, carrying plenty of flesh, but with an appearance of depression strongly characteristic of something more than the irritation caused by the presence of a stone in the bladder, as his symptoms otherwise were not more urgent than the disease often excites in a healthy subject. His urine was much loaded with mucus, which, under exercise, assumed a bloody tint; and the pulse was quick, without any external cause of excitement to make it rise. The bladder refused to receive more than an ounce of water by injection, and that gave him severe pain: this was followed by a slight rigor. From day to day I examined the state of his water, and found it uniformly of a dark colour; the lower third of the utensil was filled with mucus of an unhealthy character; and pyrexia was present, though not of a severe form. No improvement took place in his symptoms, under the plan of medicine and diet that I prescribed for him: and as there was no appearance of his being able to undergo any operation in a short period of time, I advised him to return into the country, and, under the treatment of his medical attendant, to obtain all the relief he could, before the operation was performed. He made no complaint of pain in his loins, except after more than usual exercise, and on the occasion of attending the musical festival in Westminster Abbey. He became worse after his return home; and in a short time he died. Mr. Jubb, of Halifax, inspected his body; and found the kidneys greatly disorganized, absorption of the tubular structure to a great extent, and the pelvis of each kidney filled with a puriform secretion. In the bladder were found three stones of a considerable size.

One principal source of irritability of the bladder is a morbid condition of the cervix or of the prostate gland. The structure about the neck of the bladder, above all others

deserves the especial attention of the lithotritist; as it is here that he will meet with the most difficulties, and will also find the chief source of danger. The extreme susceptibility of this part of the bladder is not unfrequently evinced in severe rigor, and inflammation following the introduction of a sound in patients who complain of dysuria connected with an enlarged prostate gland. These persons, often highly disposed to inflammation, have a severe attack, brought on by the casual introduction of an instrument for the purpose of ascertaining the cause of their ailments. When the morbid condition of the gland is combined with calculus, the risk of inflammation, and the danger of its consequences, become greatly increased; and the hasty performance of lithotrity in persons not prepared for the operation has been known to induce a fatal cystitis. Too much caution cannot be used in ascertaining the exact condition of the neck of the bladder, by occasional examination with the sound; not only with the view of learning the physical state of the gland, but also of measuring the degree of susceptibility. The irritability of the cervix, instead of being increased by the catheter, is often considerably diminished by the careful and occasional introduction of a large instrument, more especially if assisted by regulated diet and alkaline saline medicines; whereas, if the operation be performed without such preparation, on a person enjoying high health, the combined efforts of the sudden distension of the cervix and prostate gland, the reduction of a hard stone into angular masses, that are propelled, at each time of voiding urine, into the prostatic part of the canal, and the natural susceptibility of the bladder, bring on a degree of inflammation that is with difficulty arrested. I shall have occasion hereafter to explain more particularly the danger to which the manipulation of the percussor exposes the neck of the bladder and prostate gland.

The presence of calculi in the kidney cannot always be ascertained before the operation is performed; nor does this seem to be important. If they are large, their existence is sufficiently indicated by the symptoms they occasion: and if small, they will descend down the ureter, without occasioning more than slight irritation of the system. One

of the first patients on whom I operated had frequently been the subject of small phosphatic stones in the kidney ; which, under exercise, would cause lumbar pains, and other signs premonitory of their descent into the bladder. On the day after that on which the stone was crushed for the first time, he experienced a severe rigor, with pain in the left loin : these were followed by a continued form of fever that lasted for two days, when he was relieved from the pain in the loin and ureter by a small stone escaping through the urethra, which could be distinguished among the fragments of the large calculus. Any person observing the patient under his attack would have thought him in imminent danger ; but his surgeon, Mr. Wotton, who had often attended him in these attacks, knew their cause, and, with confidence, predicted a favourable termination as soon as the calculus entered the bladder. This gentleman had subsequently similar attacks during the sittings required for the complete destruction of his calculus, and rose from them as well as if nothing unusual had occurred. When the presence of a renal calculus is combined with disease of kidney, the case assumes an altered aspect, and one highly unfavourable for the operation.

We will suppose, then, all the circumstances of the patient to be favourable ; his constitution good ; the stone not large ; and the bladder sound and capacious. Let us follow the several steps to be observed in the operation of crushing the calculus.

I shall premise the importance, if not the necessity, of a couch for the patient, in preference to a common seat or bed, for the purpose of fixing the pelvis more steadily, and giving it a more convenient direction for the operation. The line of the bladder's axis cannot be too closely observed by the surgeon, in order to avoid any violence being inflicted on its parietes, when the stone is seized, and the act of crushing commenced. Fragments of small size may be broken down without the assistance of a couch ; but an entire stone requires a degree of force that cannot be safely exerted without the assistance of a fixed point of support. The preliminary step of dislodging the stone, or

tilting the patient backward, cannot be accomplished without it. Both for safety and convenience, a couch ought to form part of the operator's apparatus.

The chair represented in the Plate, *fig. 9*, is one that I have had so constructed as readily to be taken to pieces for the convenience of travelling. It is made of beech, with a bedding of common ticking, which can be rendered more easy to the patient by a pillow behind his back: the pelvis sinks sufficiently to bring the urethra nearly on a level with the vice; which thus requires not to be so much raised, and is thereby rendered steadier. The four legs are about an inch and a half longer than the hind ones, in order to give a more convenient direction to the percussor when fixed in the vice, and also to give a greater inclination backward to the pelvis. While injecting the bladder, and also during the operation of crushing the stone, the operator sits before his patient; which position is preferable to standing, as the body is more at ease. In other points, as the strap for supporting the patient's shoulders when tilted back, the supports for the feet, and the adjustment of the vice, it resembles Heurteloup's "lit rectangle."

The patient being accurately adjusted on the chair, so as to have the median line in direct bearing with the vice, the catheter is introduced for the injection of the bladder. Weiss's apparatus is the most convenient: it contains a syringe, with two catheters of different curves, that also serve the purpose of sounds. The syringe holds eight ounces, which is sufficient for all the purposes of lithotrity. The object of injecting the bladder being to protect its coats from the rude contact of the percussor, and to afford room to the operator for the manipulation of his instrument, care must be taken to throw in sufficient for these purposes, but not to distress the patient by distending his bladder more than is required. It might be thought, that the more water was injected, the more room the surgeon would have, and the more conveniently he would carry on his operations. If the bladder became distended progressively and equally, in all directions, in proportion to the quantity of water injected, the operator would obviously gain twice the space, by employing ten ounces, that he would have by

injecting only five. But such a progressive and uniform expansion does not take place, nor do the coats of the bladder continue to yield equally, throughout its whole extent, to the pressure of distension, as the quantity of fluid is increased. On the contrary, in making the experiment on the dead subject—which, though not conclusive, affords the best proof we can obtain—it will be perceived, that whilst, at first, nearly an equal increase takes place in all its parts, the injection of the last ounce or two of water principally distends the base and fundus of the bladder, where the operator does not require so much additional space.

A resistance is sometimes experienced to the injection of water, in consequence of the end of the catheter not being fully introduced into the bladder, the eyes of the instrument being obstructed by the side of a large prostate gland. The force required to overcome the obstruction is considerable, and occasions the patient great pain. This difficulty, when understood, is of course readily obviated. Sometimes the bladder is rendered irritable, and is indisposed to expand under injection, from the loaded state of the rectum. It is right to administer a dose of castor-oil early in the morning; and to empty the lower bowel, by an enema, an hour before the operation takes place. I have never found any necessity for using opiates, to allay the irritability of the bladder.

The lithotrite being warmed and oiled, is then to be introduced without loss of time, to prevent the water escaping. Its introduction ought to be effected without violence. If the operator feels more than usual opposition to its entrance at the neck of the bladder, he ought to abstain from forcing it through the prostate, under the erroneous idea that spasm arrests its progress. The closure of the neck is owing to fulness of the prostate from vascular turgescence, or from infiltration; and such a condition is unfavourable to the operator, both as respects the probability of inflammation following, and the difficulty of expelling the fragments through the contracted tube. It is better, under such circumstances, to defer the operation, and, by local depletion combined with alkalies, to assuage the irritation. Force ought to be particularly avoided in the introduction of the instrument;

as hæmorrhage into the bladder may follow, and greatly add to its irritable condition. About four years ago, before I was aware of the necessity of preparing the patient for lithotrity, I attempted to perform the operation on a very stout gentleman of plethoric habit. Although the instrument was introduced with care and gentleness, he complained of suffering much pain; and the bladder was very irritable under injection, endeavouring every few seconds to send out the water with spasmodic jerks. After walking home, he had extreme desire to make water; but was unable to expel more than a few highly-coloured drops, that failed to afford him any relief. His efforts at length became incessant, and his pain intolerable. The bladder being much distended, without any water flowing through a catheter that I introduced, I at once determined to open the neck of the bladder by the lateral operation; and thus relieve it both from the blood and the stone. I preferred this to the chance of removing them by injecting the bladder with water and washing out the blood; as I anticipated a recurrence of hæmorrhage, and also inflammation. The operation gave exit to about six ounces of coagulum, and a lithic-acid calculus, not of large size. His sufferings ceased; and he recovered without any untoward occurrence, leaving town in a fortnight from the operation; and has continued quite well. During the operation, he compared the pain of lithotomy with that of seizing the stone; and said that the pain produced by moving the percussor in the neck of the bladder was greater than that caused by the knife. When persons have been well prepared for the operation, the pain given by the introduction of the lithotrite is inconsiderable: and had he been reduced in bulk, his bladder would have lost its disposition to bleed, as well as its irritability.

Before the blades of the instrument are expanded, the surgeon should feel assured of its being passed beyond the prostate, and lodged fairly in the bladder. The handle should be well depressed; and the extremity of the instrument ought to move freely backward and forward in the bladder, for at least two inches. If any impediment exists to this movement of the instrument, it will be found to

arise from the sulcus of the prostate gland, in which its curved extremity is lodged. The instrument must be disengaged from the prostate before the blades are opened, or mischief will ensue. If the operator, not being aware of the cause of the obstruction, attempt to open the blades, he can succeed only by using considerable force, and by injuring, probably lacerating, the substance of the prostate gland. If, after forcibly expanding the blades, he closes them—which he does with ease—portions of the gland are caught in the teeth, and crushed as the blades close. Such an accident can only occur when the prostate is enlarged, and deviates from its usual form. In the ordinary state of the gland in the young and healthy adult, the floor of the gland and its vesical margin are tolerably level; and the instrument glides smoothly into the cavity of the viscus, and no obstruction is met with in the opening of the blades. But after a certain period of life, the prostate is rarely found to present a perfectly normal condition. Either the body of the gland is enlarged and deepened in its antero-posterior direction, by which that part of the urethra is raised, and made to form a more acute angle with the corpus spongiosum; or the enlargement takes place in the long axis of the gland, lengthening the urethra, and requiring the instrument to be introduced further before it reaches the bladder. In the latter case, the surgeon, as is well known and often experienced, imagines a catheter to be in the bladder before it has actually reached the cavity. The sides of the lateral lobes are occasionally thickened, and contract the canal from side to side: the gland thus bulges upon the blades of the lithotrite, and the projecting portions are easily intercepted when they are opened and closed. If this latter state be combined with an enlargement of the third lobe, the risk of seizing or stretching the gland becomes greatly increased; for the third lobe arrests the onward progress of the instrument, which becomes lodged in a sulcus formed by the projecting sides of the gland, the thickened cervix vesicæ in front, and the third lobe behind. In this dilemma, the operator, deceived as to the position of his instrument, endeavours to overcome the unknown resistance, forcibly draws back the male blade, and strains or even tears the

gland; and, in again bringing it in contact with the other, probably catches, and irretrievably injures, some portion of its substance. From observations of the different conditions of the gland in persons on whom I have operated, and the different degrees of irritation produced by the operation, according as more or less care has been taken to avoid these accidents to these portions of the canal and bladder, I am induced to attribute some of the fatal results, that have been found unexpectedly to follow the operation, to a want of caution in its early stage. Too much care cannot be employed in feeling the state of the gland while passing the lithotrite, if its condition has not been precisely ascertained before the operation; nor can too much stress be laid on the importance of feeling the end of the lithotrite move freely in the bladder, before any attempt is made to open the blades.

As soon as the extremity of the percussor is found to move freely toward the back of the bladder, the blades are to be opened, and the extremity slightly depressed into the lower part of the cavity. The chair being suddenly thrown back, the shock communicated to the pelvis, combined with its altered position, throws the stone into the most depending part of the bladder, and thence, almost with certainty, upon the female blade of the instrument. Maintaining the same position of the instrument, the operator then closes the blade upon the stone, and, having secured it, restores the chair to its horizontal position. Some care and skill are now required in fixing the lithotrite in the vice, to avoid injuring the back of the bladder in the act of percussion, and to prevent the prostate and neck of the bladder being bruised. The former is the lesser evil, and is also more easily avoided. A slight motion of the instrument backward and forward gives a correct impression of the extent to which it may be carried. The stone should then be conveyed as far from the neck of the bladder as it can be, without coming in contact with the back part of the organ; and the instrument being thus poised in an easy position, so that the stone is not in contact with any part of the bladder, the vice is brought up, fixed by the winch, and screwed upon the lithotrite. The fixing the instrument ~~without~~

care may involve the neck of the bladder in jeopardy. The danger lies in raising the handle of the instrument too much, and thus drawing the open blade with the stone into the sulcus of the prostate. The operator may easily do this without being aware of it; and it is only necessary to be apprised of the danger, to avoid it. When the gland is enlarged, the instrument almost of itself slides into the gland: and if it be allowed to move while percussion is going on, the end of the instrument is driven with force against the gland; or some portion of it gets between the blades, and is crushed when they are closed.

The best instruments combine the power of the screw with percussion, by means of the hammer. The former gives more power: the latter has some advantage, in more completely breaking up the stone into fragments. If the stone is hard, the screw will be more efficient in making an impression on it; and the operation may be completed with the hammer. I need not here describe the various kinds of instruments that have been constructed. Those of Heurteloup are large, and their teeth enable them to crush a calculus very effectively, but they do not clear themselves; and if a portion of reduced calculus happens to clog the instrument, there is difficulty in closing the blades. Weiss's percussor possesses the advantage of clearing itself, one blade being received within the other: it does not crush the calculus into powder, but breaks it up into fragments sufficiently small to pass through the urethra. Its size also renders it a most convenient instrument to introduce. I consider Weiss's the safest and most powerful lithotrite that has yet been constructed; and it is well calculated to prevent such accidents as are said to have occurred.

The best test of the crushing process being conducted properly is the absence of pain and of hæmorrhage. During the most powerful use of the hammer, consistent with the strength of the instrument, little or no pain is experienced by the patient, if it be well secured in the vice. The vibration occasioned by the blows of the hammer are transmitted to the chair; and frequently the patient is unconscious of the instrument being struck. The operation is usually bloodless. In some persons, whose vascular tissue

is delicate, a slight tinge of blood is discerned in the water : but more frequently, where gentleness is observed in all the manipulations of the operator, the water is expelled colourless.

The seizure of the fragments of calculus may be repeated several times, during one sitting. When the bladder is not irritable, it may be repeated from five to eight times, and a large part of the stone effectually reduced to a state fit for expulsion. The sensations of the patient become the surgeon's best guide in repeating the operation at the first sitting. Before the instrument is withdrawn, or even closed, it should be moved from its situation, to ascertain that no fibre of the prostate is entangled between the blades : it is then to be closed, and withdrawn. In a minute or two the patient voids the water, and some sand or small particles of the stone ; the larger portion remaining behind, to be expelled by the bladder, which, by degrees, recovers its tone, and becomes excited to contract with effect.

Sufficient time should be allowed for the escape of the fragments, before another sitting takes place. The sand and smaller particles are voided first from the bladder ; and then, by a more powerful action of the organ, the larger pieces are expelled. Three or four days are usually sufficient for the expulsion of the whole of the fragments, especially if the patient is able to walk about, and to excite the bladder to contract. In healthy persons, who experience but little suffering from the operation, no subsequent inconvenience is produced ; and they are able to take their usual exercise, and to attend to their ordinary occupations. I operated, with Sir A. Cooper, last summer, on a gentleman who had three calculi in his bladder, but enjoyed good health. On the day following the operation, he walked out three miles from his house, for the purpose of assisting the expulsion of the fragments ; understanding from me that exercise would have that effect. It is best to let patients consult their feelings on the subject of exercise. Sometimes a slight degree of fever, requiring a little confinement and nursing, succeeds the operation, but rarely lasts beyond twenty-four hours. An opiate is seldom required.

If the patient's rest is broken, it is occasioned by the passing of fragments, which he feels anxious to encourage. When a large fragment enters the canal, and cannot force its way, it produces some irritation, and an urgent desire to pass water; and making some progress at each time of voiding urine, it gradually comes up the urethra, until it reaches the glans, through which it may require to be assisted by a bent probe or the urethra forceps. The fragments are so enveloped in mucus, that they rarely remain impacted in the urethra. If the prostate swells, sometimes a piece of the stone forces its way into the urethra, and its progress is obstructed. Considerable irritation follows; the desire to void urine becomes incessant, and the attempt painful; and the fragment must either be forced back again into the bladder, and reserved for another operation; or the urethra forceps must be introduced, to seize and to crush it, if it be too large to pass. Such impediment to the passage of a portion of calculus, however, is rarely met with; as it generally falls back into the bladder.

A judgment cannot always be formed of the entire expulsion of the calculus by the patient's feelings after the operation. The pain caused by the stone will not unfrequently be relieved after one sitting. The position and form of the calculus being changed by the operation, the bladder no longer feels the same inconvenience; and although it is reduced to fragments, the pain after voiding urine is oftentimes much diminished. After one operation on a small calculus, the patient will frequently experience entire relief when some fragments have been passed, even though several portions still remain in the bladder. This suspension of the symptoms, however, is of short duration; for in a week or two the bladder will not fail to feel the pressure of the remaining fragments, and will be induced, by repeated painful efforts, to endeavour to eject them. The symptoms, therefore, may, in some instances, be suspended after an imperfect operation; and the patient will, for a time, suppose himself cured. The change from a state of great suffering to comparative ease deceives him, and may cause him, by a false estimate of his feelings, to mislead the operator. The time thus lost may inflict a

positive evil on the patient; for the bladder, instead of losing its irritability by the suspension of the pain and excitement, will occasionally become exceedingly sensitive, and ill able to bear the subsequent operations necessary for the complete crushing of the stone. The mischief arising from delay is more serious, when the bladder becomes greatly irritated, and secretes a large quantity of mucus containing the phosphates. These become deposited on the fragments; which rapidly increase in size, and cause much aggravation of the patient's sufferings. In a healthy bladder, the portions of stone may remain unchanged in appearance, except a slight rounding off of the sharp edges and angular projections; but more usually they are coated with a layer of phosphatic deposition. The occasional quick deposit of phosphates, on a gum catheter that has been allowed to remain in the bladder for ten or twelve days, will serve to illustrate the evil of allowing fragments of a stone to reside long undisturbed in the bladder.

Many instruments have been constructed for the purpose of evacuating the bladder. Weiss has several, ingeniously contrived; but I cannot speak of their efficacy from experience, as I have not had occasion to employ them. A friend has suggested the use of the common enema syringe, for injecting the bladder with warm water through a large-sized catheter, and drawing out the water by exhaustion. The fragments are taken up by the syringe, and the bladder emptied. The idea of employing the syringe arose from the assistance he had derived from it in removing a large quantity of coagulated blood from the bladder, in a case where retention was induced by hæmorrhage.

In the usual manner of breaking down a stone, several operations are required, unless the stone be very small. No lithotrite can be made large enough to embrace a stone of moderate size, and at one seizure entirely to crush it; nor can the patient endure the fragments to be seized more than a certain number of times. Indeed, it is hardly prudent, with the common instrument, to occupy a long time in the operation, or to persist in seizing the fragments until they are sufficiently broken down. Those who are experienced in lithotrity allow that the danger arises from doing too much at one sitting; and that the patient suffers much

less when the operations are performed at stated intervals, than when concluded at once. It is however obvious, that much would be gained, if the stone could, at one seizure, be entirely broken down, without inflicting any violence on the organ: the necessity of repeating the operation would be avoided, and the danger of injuring an irritable bladder diminished. For when the fragments escape into the bladder, the number of operations required is often considerable: and there is more chance of leaving one behind in the bladder, than when the stone is crushed into small portions at one sitting.

The defect in the operation of lithotrity, as performed by the percussor, appears to consist in the escape of the fragments from the blades of the instrument before they are sufficiently broken down to pass through the urethra. The larger, however, the blades are, the more complete will be the crushing of the calculus at any given number of seizures: the operator employs, therefore, the largest instrument he can introduce into the canal. To prevent the escape of the fragments appeared to me to be the desideratum. The other parts of the operation had been brought to great perfection: the seizure of the stone had been rendered a matter of certainty; the percussion of the hammer was productive of no uneasiness; and the command of the blades, in crushing the stone, was complete. Some contrivance, however, seemed to be required, to prevent the necessity of repeating the operation.

About three years ago, I proposed to an ingenious mechanic, from Suffolk, the projection of two lateral blades, to support the pieces of stone while under the action of the instrument; but the execution imperfectly answered the purpose. The instruments were, I believe, shewn to the Society of Arts. Accident led me to contemplate the possibility of adapting a net-work, for the purpose not only of catching the fragments, but also of throwing them between the teeth of the percussor, in the act of withdrawing the male blade. Mr. Laundry carried into effect the idea that I had suggested to him, and proved that an instrument might be so constructed as to effect both these desirable ends.

The percussor that seemed to be the best for my purpose

was that made by Weiss: the great power that it possessed over a calculus, and its property of clearing itself, were two advantages that no other lithotrite, that I had seen, possessed; and, at my request, he constructed a lithotrite with an addition of two branches, projecting by means of wires concealed in a groove at the upper part of the female blade. *Fig. 1.* represents Weiss's lithotrite, with the branches added to it. They move by means of a handle attached on each side of the instrument. When the instrument is closed, the handles are fixed by a screw and eye to the upper part of the male blade: the branches are concealed when the blades are closed; but are seen lying close to the sides of the male blade when the latter is withdrawn. The branches are pierced with small holes, for the purpose of fixing the net, as is also the posterior part of the male blade itself, as is shewn in *Fig. 2*: one end of the net being fixed to the blade, and the other to the branch, when the latter is projected, it expands the net on each side of the calculus. The net occupies so small a space, that, when gathered up, it lies close to the side of the blade, which is slightly excavated to receive it, and does not interfere with the blade closing perfectly. See *Fig. 3.*

When the instrument is closed, ready to be introduced into the urethra, the blades appear in no way to differ from those of the ordinary lithotrite, except at the back of the female blade; in which I have had introduced small bars, so as to intercept large fragments, and prevent them from escaping before they are sufficiently triturated: these are seen at *Fig. 4.*

For the working of the instrument in the bladder, at least six ounces of fluid should be injected, to prevent either the blades or the branches from touching the sides of it, and to allow the male blade to be withdrawn to the extent of an inch and a half, or even more, if the stone be large. The bladder, when healthy, will readily hold half a pint; and the larger the quantity injected, the greater will be the security against contact with the mucous membrane; which, even if it were productive of no injury to the bladder, would embarrass the operation. To facilitate the working of the blades and branches, I inject, instead of water, oil, mixed

with warm water by means of powdered gum: this forms a good lubricating medium for the movements of the net when the male blade is opened and closed, which would not otherwise slide along the wire, and would tend to displace the branch when the act of crushing were commenced.

The stone being seized in the usual manner, the first step to be taken is to envelop the stone in the net: this is effected by removing the screw, and propelling each branch by sliding the handle forwards, and slightly outwards, so as to avoid its coming in contact with the stone. Instead, however, of propelling the branch in an oblique direction, it is better to turn the stone to one side, by inclining the whole instrument, and to let the branch advance in a straight line: the branch, by proceeding thus, meets with no impediment, and easily accomplishes the object of passing beyond the stone without touching the sides of the prostate gland, which it is liable to do if everted or inclined outwards (see *Fig. 5*). The other branch is to be projected in the same manner, until the stone is encompassed by the netting. Should the stone project too much at one side to allow one branch to pass, the instrument is to be turned to the opposite side; and such an inclination given to it, that, when the blades are opened, the stone shall fall into the side of the net that is expanded: a manœuvre which is readily practised, after a few trials with the instrument. This being done, the instrument is to be carried as far backward in the bladder as its cavity will permit, and then fixed in the vice.

As the stone may be seized in a manner unfavourable for the action of the lithotrite (as, for example, by the extremity of its beak), and the pieces when crushed would immediately fly from the blades, it is necessary to have the stone so placed as to secure it in the net when under the operation of the teeth. To effect this, the handles of the branches are to be secured (as represented *Fig. 7*), by projecting them as far forward as the catch at the under part of the instrument, and then fixing them: this will give an outward direction to the branches at the extremity of the instrument, as seen in *Fig. 6*. The branches being held in this position, and fixed by making pressure on the handles with the finger and thumb, the male blade is to be withdrawn; and the stone,

whatever be its position, will, of necessity, fall into the expanded nets. In the ordinary mode of operating, however disadvantageous be the position of the stone when seized, the crushing must begin without the power of altering it. This may be one cause of the male blade having, in more than one instance, yielded to the force of the hammer, when acting on a stone held by the extremities of the blades. The lithotrite acts with great disadvantage on a stone so placed; and it is one recommendation of the net, that the calculus is thrown between the blades, where they can act with the greatest power on the stone, and with the least risk of breaking or yielding.

The branches are next to be secured on a level with the outer part of the female blade, as represented in *Fig. 8*. The handles are therefore to be advanced as far forward as the eye in the under catch, and to be secured by passing the screw through them (*a, Fig. 1*). The instrument being thus adjusted, and poised in the posterior part of the bladder, in order to allow sufficient room for opening the blade without pressing the prostate, or neck of the bladder, the operation of crushing commences. The alternate closing and opening of the blades will explain the principle on which the instrument acts. The screw is to be turned upon the calculus, in order to crush it; and for this, but little force is required, even when the stone is hard, if the instrument is constructed true. The blade is to be withdrawn suddenly; and the fragments will fall immediately before the blade, and ready to be crushed when the screw is again turned. By opening and closing the instrument as fast as the hand of the operator can move the screw, the stone is gradually broken up into fragments of small size; which escape, through the meshes of the net or the end of the instrument, into the bladder. The portions of stone are not too large to pass through a healthy canal. Before concluding that the stone is entirely crushed, the operator should unscrew the vice, and turn the instrument, first to one side and then to the other, that any fragment of large size, lodging within the net, may be tilted between the blades, and be reduced to smaller size. Having satisfied himself that the operation is completed, he then proceeds to close the instrument; first taking

care that no fragments remain entangled in the net. **This** may be ascertained by drawing back the net on one side; and inclining the instrument to that side, in order to throw out any pieces that may adhere to the meshes: the same is done in the opposite direction; and the nets, being cleared, are to be closed, by carefully drawing back the branches, and securing them to the male blade by means of the screw. When the blades have been securely closed, the instrument is withdrawn. The net, being oiled, produces, in its passage, no uneasy sensation.

In working the instrument, there is no danger of injuring the bladder, as the branches are not moved in the operation; or, if a piece of stone is forced outward, the net yields, and the branch with it, but they return to their places by the elasticity of the steel wire. It may be observed, that there is very little chance of the stone displacing the wires; as they are below the level of the female blade, and do not receive the pressure of the calculus. And if the net has to bear more than usual pressure from an angular fragment of stone, it has to sustain it when the male blade is advancing under the action of the screw; and thus the pressure becomes diminished, by the net being relaxed when the instrument closes. In using the instrument, it will be seen that the same force which projects the stone laterally against the net takes off the pressure from it, in the act of closing the instrument. The net, therefore, though apparently made of slight material, will rarely be found to be injured in any of its meshes, if well made, and properly secured. It may also be observed, that the weight of a stone, in fluid, is considerably diminished; so that a very slender thread will support a calculus in a dense medium like oil and water.

It will be at once seen, that a certain extent of space in the antero-posterior diameter of the bladder is required, for the safe movements of the instrument. An accurate measure of the bladder in this direction can easily be taken, by injecting the bladder, and employing the short-beaked catheter. The operation requires a certain space for the manipulation of the instrument: it will therefore sometimes happen, that want of capacity, either from enlargement of the prostate or from a distended rectum, may altogether

forbid its performance. An enlarged state of the gland, narrowing the antero-posterior diameter of the bladder, is an obstacle that cannot be well overcome; and some danger may arise by the operator persisting in the attempt, from the injury which the gland cannot fail to sustain in the opening of the blades. Want of room is sometimes owing to sufficient fluid not being injected: in which case, time must be given for the irritability of the bladder to cease, if it is not able to retain a sufficient quantity. I have, on two or three occasions, been obliged to lay aside this instrument, and use the common lithotrite; as it is more prudent to desist, than, by an undue degree of force, to incur the risk of producing irritation, or injuring the neck of the bladder. I have used the instrument in four cases: in the two first there were large fragments, the *débris* of a former operation with the common lithotrite: these were readily broken up; and the successful result induced me to employ it in two cases of small lithic calculi, with complete effect. These cases have been sufficient to convince me, that it may be generally adopted; and that the exceptions will be only occasional, from the causes which have been mentioned.

In trying to lay down rules for the performance of an operation like lithotrity, that requires and depends upon manual skill, I feel that the best advice the young practitioner can receive, is, to gain a familiar acquaintance with his instruments, by frequently operating on the subject. No rules can supply the want of practical dexterity; and this, as in other mechanical arts, is to be acquired only by continued practice. Theory will do little for the lithotritist. If he expects that a general acquaintance with its principles, and with the action of an instrument, will render him expert in the performance of the operation, he will find that he will obtain experience after repeated failures, and at the expense of severe suffering and hazard to his patient.—I trust that the foregoing remarks will serve to point out in what the danger of lithotrity consists. Expertness in operating can be acquired only by long experience and frequent practice.

EXPLANATION OF THE PL

Fig. 1. represents the lithotrite closed. In general appearances, that may be used either with a hammer or without, the motions to his instrument consist of two wires or branches, which are seen fixed to the male blade by means of a screw, and sealed in the body of this instrument; except at the extremities, in which they are lodged. The groove is left in the movements of the wires, when they are projected, and when the blades are closed, the branches are not seen, being closed in a hollow of which they lie.

Fig. 2.—The blades are opened, to shew the perforations in the net, and the branch lying close to its side. The holes are only; one at the extremity, and another at the corner, sufficient to secure the net, which slides backwards or forwards as the male blade is opened or closed.

Fig. 3. shews the net, as it appears when the male blade is opened, and the net is lodged in it, when the instrument is closed, the net is slightly excavated; so that when it is introduced, the net is also secured from the blades, and from being intercepted by the blade and the calculus. The net is most readily secured when the blade is nearly closed.

Fig. 4. is a posterior view of the female blade; which in Weir's is entirely open, but in this instrument has transverse bars, to prevent the fragments that would otherwise fall through.

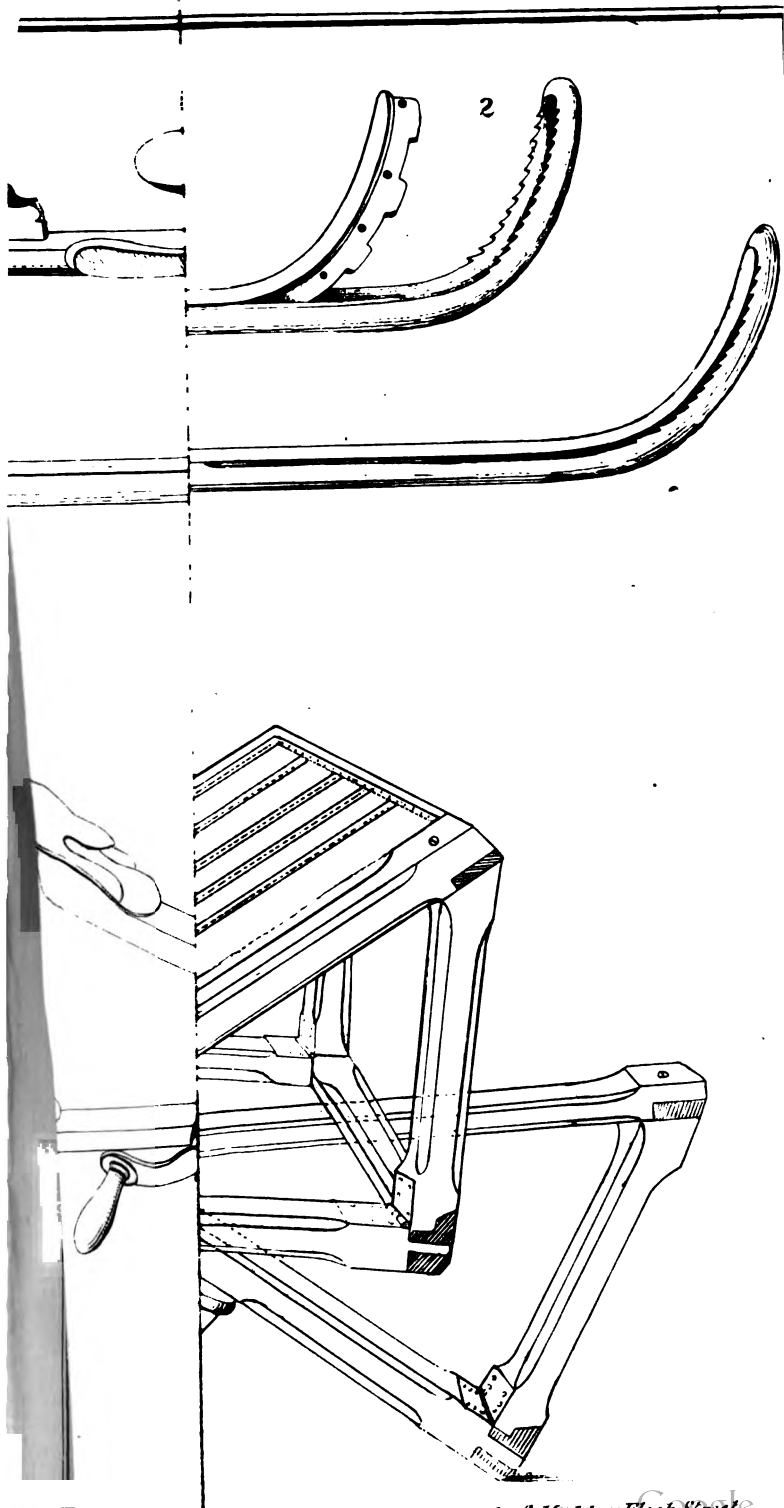
Fig. 5. represents the instrument with the stone, and the branch protruding the net to envelop the calculus. The view intended in the figure is somewhat deficient in perspective, and does not accurately delineate the position of the blades. The object when the branch is protruded on either side, the instrument, is to be inclined slightly to the opposite side, so as to let the branch go directly forward in the central axis of the bladder. If the instrument is straight, and the branch is inclined outward, it is liable to be caught in the prostate, and to be impeded in its movements.

Fig. 6.—The calculus is seen held in the blade of the lithotrite, and the branches, with the net, are viewed expanded in the oblique position to prevent the stone escaping when the male blade is drawn back. The branches are kept in this position, by fixing their handles in the net, as shewn, *Fig. 7.* If the stone be caught in a position the most unfavourable for crushing—as, for instance, by the extremity of the blade—its position may be changed by opening the blades, and it will be made to fall into the net with the greatest precision. See p. 52.

Fig. 7. is explained in the preceding figure.

Fig. 8.—The instrument enclosing the stone is seen with the net expanded, and the branch secured by the side of the female blade. It lies close to the bladder, without the possibility of touching the bladder. The net is made of elastic material, but sufficient to assist in retaining the fragments. As the instrument advances in the act of crushing the stone, the fragments are forced against the net; and at the same time the net is relaxed, and the pressure against it is diminished: the wire also is elastic, and yields to any lateral motion. But as the male blade recedes, the net is put upon the stretch, and the fragments are forced inwards between the two blades, in which position they are to be again submitted to attrition. The complete operation of the net is, however, be thoroughly understood, without seeing it in action.

Fig. 9. gives two views of the chair: one in the horizontal position, as the patient lies when under the operation. The operator sits between the patient's legs. The other view shews the chair tilted back, with the hind part resting on the ground, and the fore part thrown upward. In this position of the chair, the surgeon stands before his patient. Very little force is required to raise the chair, and throw it back; and the jar which the patient receives by the back coming in contact with the ground will dislodge a stone or fragment from behind the prostate gland.



OBSERVATIONS
ON THE
DIAGNOSIS
OF
P N E U M O N I A.

BY DR. ADDISON.

ANY attempt at a further elucidation of pneumonia, after the splendid performances of Laennec, may probably appear presumptuous; and especially so, when made by one who acknowledges himself indebted for almost all that he knows of thoracic diseases to that truly great man, at once the most distinguished and most successful cultivator of medical science that ever adorned the profession. When, however, it is recollected how vast and barren was the field of his inquiries when he commenced his brilliant career—and when our former ignorance is compared with the knowledge that resulted from his unprecedented discoveries—our astonishment is, not that he should have left something undone, but that he should have done so much. It is with the most profound deference and respect for his memory, therefore, that I venture to add this tributary mite to the riches of one of his favourite essays. I cannot but feel, also, that some apology is due to the profession, for presuming to direct attention to a subject with which the works of Laennec must already have made them familiar; and particularly to those who have so far resisted the influence of prejudice as to have made themselves conversant with the use of the stethoscope. My apology is, that the very familiarity of the subject appears to have lulled medical men in general, and even the stethoscopist, into a too passive confidence in what is already known: and has probably proved a check to that correction and improvement which Laennec himself was at all times so eager to accomplish.

The main object of this brief communication is, to make

some addition, however trifling, to the ordinary means of diagnosis ; since experience has forced upon me the conviction, that there are few acute diseases more frequently mistaken or overlooked than pneumonia, to the detriment of the patient, and the no small embarrassment of the practitioner.

In order to make myself understood, I may perhaps be permitted to take a very slight survey of the pathology, signs, and symptoms of the disease ; merely observing, at the outset, that, in doing so, I shall adhere as closely as possible to the purely practical tenor of our Reports ; indulging in theory no more than is unavoidable, in arranging and reasoning upon facts derived from the sick chamber and the dissecting-room. To the facts, or supposed facts, alone, do I attach any importance. The use of these facts must be left to the judgment and discernment of the reader.

In pneumonia, the inflammation is manifestly seated in or around the air-cells, or in both situations. It is perhaps of little importance, whether we conclude it to be seated primarily and essentially in the one or in the other of these structures : although, for my own part, I entertain no doubt whatever of its being primarily and essentially seated in the interior of the cells themselves—a belief drawn from the successive local changes observed to take place as the disease advances. In the first stage of the disorder, we find the cells red, and filled with a serous-looking and sometimes bloody fluid, rendering the lungs more heavy, dense, and œdematous, whilst they still retain their tenacity. At a more-advanced period, or second stage, the cells are found filled up with red solid matter, which appears to consist of the thickened parietes of the cells themselves : for if the lung be torn, and the torn surface examined with a magnifying-glass, it seems to be made up of innumerable minute red grains, just such as one might conceive to result from a filling-up of the cells in the manner supposed. At this period, the serous-looking fluid has disappeared, the lung is comparatively dry, and the tenacity of the solidified part is so far diminished, that it may be readily broken down by forcing the finger into it : this is what has been called red hepatization. At a later period, and sometimes apparently without having been preceded by the red granules,

the solidified lung presents a grey appearance, an albuminous matter seems to occupy the place of the granules, or rather their centres, constituting the grey hepatization. This albuminous matter is sometimes firm and fixed, at other times it is less plastic, and occasionally, especially in bad constitutions, takes on a more decidedly purulent aspect, and may be squeezed out by pressure; or, as the cohesion of the pulmonary tissue is often, under such circumstances, very much diminished, the slightest pressure of the finger causes it to break down into a semi-fluid mass, resembling an abscess.

It is not necessary to be more minute in describing the pathological changes which take place in the progress of pneumonia: it is sufficient to remember, that, in the first stage, the cells contain air and a serous-looking and sometimes bloody fluid, as shewn by the peculiar crackling sound, and escape of the fluid on squeezing a cut surface;—that, in the second stage, the cells are solidified, comparatively dry, and, sooner or later, have poured into them an albuminous matter, either solid and fixed, or, more rarely, a matter approaching the character of pus. The stethoscopic signs indicative of these respective changes are such as might be expected, and are easily understood. Whilst the cells contain air and serous fluid, there is little or no dulness of sound on percussion, but during respiration, we hear the crepitating rattle—a rattle which undoubtedly depends upon the presence of air and fluid in the cells, for it is observed in cases of œdema of the lungs, and in some instances of pituitous catarrh, as well as in the first stage of pneumonia. When the cells are solidified, and admit no air, we have dulness of sound on percussion, bronchophony, and bronchial respiration, at least when the consolidation is considerable, and seated near the surface. Such are the stethoscopic signs of simple pneumonia: they are quite characteristic, and are pretty uniformly present, except under very peculiar circumstances.

If an opportunity present itself of examining the body, when a lung consolidated by pneumonia is retrograding towards a recovery of its normal state, we commonly find the cut surface of the portion previously hepatized of a pale

or pinkish hue; or we find it presenting a mixture of pale, pink, and grey: it is still more friable or lacerable than natural; and the cells are again more or less loaded with serous-looking fluid, rendered frothy by squeezing the lung, in consequence of the presence of a considerable number of air-bubbles. It would also appear, that the further changes consist in the absorption of the effused fluids, a gradual increase of the tenacity of the pulmonary tissue, and a more or less complete restoration of the normal state. In some instances, however, when the albuminous matter thrown out is of the more plastic or organizable kind, it fails to be entirely absorbed, and part of it permanently remains. Under these circumstances, we find it, at an after-period, either in small, detached, and more or less rounded masses, or more extensively and more irregularly diffused through the pulmonary tissue. When distributed in small insulated portions, I believe it to constitute one of the forms of albuminous deposit, indiscriminately called tubercles; whereas, when more extensively and irregularly diffused, it has, in like manner, been regarded as a form of tubercular infiltration. The history, however, of the patient's case, in many instances, as well as the local appearances themselves, lead me to the conclusion, that they are merely the result of a previous attack of pneumonia. We often learn, on inquiry, that, at some former period, perhaps years before, the patient had had an attack of inflammation within the chest; whilst, if he die of some other disease, we almost uniformly discover, on dissection, unequivocal evidence of antecedent inflammation. The evidence consists in thickening and adhesions of the *pluræ*, especially in the neighbourhood of the appearances in question, together with induration and puckering of the pulmonary tissue immediately surrounding each albuminous deposit: or, when the deposit is irregular and extensive, we often have an actual deformity and puckering of the *pleura* above the infiltrated parts. This view of the origin of these albuminous deposits will probably serve, in some measure, to explain why they are much less uniformly found in the apices of the lungs than ordinary tubercles.

It has been observed, that these deposits may remain

passive for an unlimited period, and without undergoing any very appreciable change, except perhaps a conversion of some of them into calcareous or chalky masses, especially when deposited in the upper lobe of the lung: it would nevertheless appear, that the vital influence by which they are maintained in their integrity is so extremely slender, that if inflammation happen to be set up around them by any accidental cause, and especially if the vital powers of the patient have been greatly impaired, that influence is so far exhausted, that they lose their cohesion, and soften;—the softening commonly first taking place in those portions most remote from the more highly organized living-structures: they soften in the centre; the softening proceeds outwards, and, in the end, causes the formation of a vomica, and so produces one of the modifications of phthisis pulmonalis. Such, at least, are the conclusions to which repeated observation of the living, and dissection of the dead, have led me, in regard to this part of the subject.

Having premised these very superficial remarks, I shall now proceed to the reputed functional signs or symptoms of pneumonia; for it is to the unsteadiness and fallaciousness of these, that errors in diagnosis are chiefly attributable; and, consequently, it is to them more particularly that I am desirous of directing attention.

The characteristic symptoms of pneumonia enumerated by Laennec, are, an *obtuse and deep-seated pain in the chest, dyspnœa, hurried respiration, cough, and peculiar expectoration*: but, in reference to these, he tells us, that each of them individually may occasionally be absent, and, indeed, that they may all be absent in the same case. Now, were it quite correct to assume that the character of pneumonia is that which is expressed by the above symptoms, that the reputed deviations and exceptions alluded to by Laennec are only of very rare occurrence, and that obscurity happened only in the pneumonia of old people, and in cases complicated with other diseases, there might probably be some excuse for resting satisfied with the present position of the subject: but if it be as true, as I am convinced it is, that these reputed deviations and exceptions, regarded as obscure, are of extremely frequent occurrence, that they

are met with at every period of life, and in every variety of constitution; and that they are very far indeed from being limited to old persons, and to what have been called complicated cases; I hope to be pardoned if I make an attempt, in some degree to unravel the difficulty, and place the subject, if not in a more correct, at least in a more safe and practical point of view.

I have been led to the conclusion, that cases of pneumonia characterized by obtuse and deep-seated pain, dyspnoea, hurried respiration, cough, and peculiar expectoration, are, in truth, themselves the exceptions, in a pathological sense; and that, although most frequently met with in practice, they are, in fact, cases of complication. It may be said, if such cases of complication be those most commonly encountered in practice, why interpose a mere pathological subtlety, to disturb the practical rule? To this I oppose my belief, that it is an adherence to such a general character of pneumonia that has led, and is constantly leading, to an oversight—to a neglect of the disease, when it occurs in what I am disposed to regard as its more *simple form*: and as cases partaking more or less of this simple form of pneumonia are of frequent occurrence, I am willing to persuade myself that what follows may have the effect of diminishing the liability to the errors alluded to.

In *simple pneumonia*, after chilliness, shivering, feebleness, and depression, the patient experiences, for the most part, strongly-marked symptoms of febrile re-action, giddiness, confusion, and sometimes intense pain in the head; occasionally delirium, especially towards night; *the skin acquires a pungent heat*, generally accompanied by dryness, more rarely by moisture; the pulse is full and strong, perhaps labouring and sluggish; the face is usually more or less suffused with a livid flush, accompanied by an expression of distress; the tongue is foul; its substance is more injected than in ordinary phlegmasiæ, and in a short time it manifests a tendency to become dry and brownish; the respiration is somewhat hurried, but *there is seldom any very obvious cough or expectoration, and sometimes none at all*; in short, the whole assemblage of symptoms bears a most striking resemblance to those of a severe attack of common continued,

fever of the typhoid type, for which it is so repeatedly mistaken. If this form of the disease occur in moderately good constitutions, and is overlooked, especially if stimulants be administered on the supposition of its being a severe case of typhoid fever, it very commonly happens that the general prostration increases, the delirium or oppression of the brain is aggravated, the tongue gets dry and black, and the teeth covered with sordes; the breathing becomes more hurried, occasionally with a frequent slight hacking cough, and now and then a little bloody expectoration; the pulse gets flaccid, frequent, and feeble; and at length the patient dies.

Notwithstanding its close resemblance to a severe attack of continued fever—a resemblance so great, that even the stethoscopist is occasionally thrown off his guard—attentive observation will, in most cases, enable us to recognise the difference. The attack, in general, is more abrupt, and often follows some manifest exposure to cold or wet. The countenance, though congested and somewhat distressed, has not the dejection and stupidity so remarkable in fever: it displays more intelligence; and, although confused and perhaps slightly delirious, the patient, on being roused, commonly evinces a clearness and vigour of intellect not found in fever. The condition of the tongue also furnishes a valuable diagnostic sign. We know that, at the onset of fever, the contrast between the vividly-injected tongue and its white or grey fur is very striking: it is, in general, much less so in pneumonia. In the latter, if I may be allowed the expression, it is more the tongue of a phlegmasia: the hurry of respiration in pneumonia is often not more than we commonly perceive amid the general distress of fever; and I repeat, that neither cough nor expectoration is necessarily present in a very appreciable degree. But of all the symptoms of pneumonia, the most constant and conclusive, in a diagnostic point of view, is a *pungent heat of the surface*. By this symptom alone, the first stage of pneumonia may, in most instances, be readily recognised: by this symptom alone, I have repeatedly pronounced the existence of pneumonia, before asking a single question, or making the slightest stethoscopic examination of the chest. The presence of this symptom has scarcely ever yet

deceived me, even in the most complicated forms of inflammation within the chest. I by no means contend that it is necessarily present at some period of every case, although I do not know to the contrary; but I feel justified in affirming, that when inflammation is confined to the chest, however varied may be the tissues involved in the inflammatory process, provided this symptom be present, pneumonia may be confidently pronounced to form a part, in nineteen cases out of twenty, and I believe in a much larger proportion.

A similar pungent heat of the surface is now and then observed in certain forms of renal dropsy; more frequently in continued fever, especially in children; and still more commonly in the eruptive fevers of the exanthemata and erysipelas: and, as such cases may supervene upon already existing disease within the chest, the fact ought to be carefully remembered, lest a most valuable diagnostic sign should rather mislead than assist us. It is in original inflammation within the chest that it proves so constant and conclusive a sign of pneumonia, but on every occasion, when present, it ought to lead to a most careful scrutiny, by means of the stethoscope.

I am unwilling to swell this communication by a detailed recital of individual cases: but were it otherwise, it would be easy to introduce a very great variety of instances, in which simple pneumonia has been mistaken for common fever of a typhoid type. I have repeatedly witnessed it in children; the first suspicion of it having generally been suggested to me by recognising, on applying the hand to the surface, the peculiar pungent heat already noticed. I not long ago had an example in a young woman who was supposed to be labouring under a severe attack of bilious fever; so called, because pneumonia of the right lung was accompanied, as is not unfrequently the case, by a sallowness, or almost jaundiced aspect of the patient's countenance. I have a very similar case in Miriam's Ward at this time, also occurring in a young female. In elderly persons it is so common, that when a case of typhus is represented to have occurred in any individual above fifty years of age, without evidence of the existence of the disease in other branches of the family, I confess that I consider it

at all times an equal chance that it is, in reality, a case of pneumonia. An instance of this kind I saw very recently: the person was upwards of 60, but of a hale constitution, and presented most of the ordinary signs of continued fever, whilst the pulmonic symptoms were so slight as never to have attracted the least attention. This brief representation may probably suffice to fix attention upon the likelihood of the presence of pneumonia in cases of supposed continued fever.

The more simple form of pneumonia not unfrequently assumes another appearance, which has occasionally led to a belief that the brain was the seat of the disorder; the original affection of the lungs being so obscure as to be entirely overlooked. I have, within a short period, seen two cases of acute pneumonia in vigorous adults, in which, at the commencement, and for some days, the disturbance of the brain was such, that remedies were applied exclusively for the relief of that organ. In both instances, the inflammation was very intense, and was, at a latter period, attended with cough, expectoration, and other signs commonly regarded as characteristic of pneumonia.

Some time ago, I was requested to see an elderly man, who appeared to be labouring under obscure symptoms of mental aberration, and was supposed to have become insane. He looked pale, his countenance was somewhat anxious, his tongue was loaded, slightly brown, and disposed to become dry, he was occasionally incoherent, and wandered about the ward in a wild and unaccountable manner, but had neither cough nor expectoration sufficient to attract any particular attention. On examination, I found him labouring under pneumonia already advanced to hepatization. He recovered. A similar case is now under treatment in the hospital.

In infants and very young children, such cases are by no means rare, and simulate hydrocephalus. In one instance, where hepatization had taken place, the most prominent symptom was convulsions, for which various applications had been made to the head.

Such are some of the affections of the brain, to which pneumonia not unfrequently gives rise—secondary affec-

tions, calculated to mislead the most wary; and such as must inevitably distract the attention, and perplex the judgment of those who do not habitually have recourse to the stethoscope.

If the representations I have made be correct, they certainly lead to an inference, that even acute disease does not, when confined to the air-cells, necessarily give rise either to cough or expectoration—symptoms, perhaps, too much relied upon, in recognising, or even suspecting, affections of the lungs.

Without arguing the question, whether it be possible to expectorate a thin watery fluid, which must necessarily gravitate in the cells of the lungs, I may venture to state, that I entertain very strong suspicion that the cough and expectoration so commonly observed in pneumonia depend altogether upon the accidental implication of the bronchial tubes, and that, without a doubt, the degree of these symptoms depends upon the degree of that implication. Certain it is, that the most intense pneumonia may exist, even in hale constitutions, with cough and expectoration so slight as to pass unnoticed; and it is not difficult to suppose, that, when so slight, they may depend rather upon mere sympathetic irritation of the minute bronchial tubes in the immediate neighbourhood of the inflamed tissue, than upon any considerable degree of actual inflammation set up in them. It is true, that, on dissection, we very commonly find the mucous membrane of the smaller tubes reddened; but whether from inflammation, or not, is by no means so easily determined. I am disposed to think, that, in simple pneumonia, the small tubes are either not at all inflamed, or only inflamed in a very slight degree, and that, when more decidedly involved, their inflamed state gives rise to the cough and peculiar viscid expectoration described as characteristic of pneumonia in general. This complication is indisputably more frequently present than absent; a circumstance little calculated to excite surprise, and one probably sufficient to account for the symptoms which attend the complication, having usually been described as those essential to, and characteristic of, pneumonia.

When cough and expectoration are as well marked as

they are commonly described to be, they cannot fail to attract the attention of every one, and all difficulty of diagnosis ceases. The same may be said of those cases of pneumonia in which we have the mucous membrane of the bronchial tubes involved to such an extent, that, by universal consent, the disease is said to be complicated with bronchitis, and in which we have the expectorated mucus, though considerable in quantity, more or less tinged of a brownish or saffron colour. It does not, however, necessarily follow, that, when pneumonia is present, the mucus of the accompanying bronchitis shall be tinged brown: on the contrary, the discoloration is often, in such cases, altogether absent, its presence and degree depending upon the quantity of blood which happens to be effused; exactly in the same manner as the ordinary *viscid sputa* of pneumonia may be colourless, or may be of a gamboge yellow, light green, or of a rusty or red colour, according to the same accidental circumstance. Of course, in these bronchial complications, we have, superadded to the stethoscopic signs already mentioned, a mucous rattle, which, when hepatization takes place, is rendered much more distinct, in consequence of the consolidated lung being a better conductor of sound.

In concluding this slender contribution to diagnosis, I shall merely observe further, that unless complicated with pleurisy, pain of any sort is rarely complained of by a patient affected with simple pneumonia, in whatever position he may be placed. When, however, the bronchial complication is such as to produce severe cough, he not unfrequently experiences a burning or tearing pain, or rather soreness, more or less diffused through the affected parts—a symptom probably resulting from the violence inflicted upon the inflamed tissue during the repeated fits of coughing.

TWO CASES
OF FATAL
POISONING BY ARSENIOUS ACID:
WITH REMARKS ON
THE SOLUBILITY OF THAT POISON, IN WATER
AND OTHER MENSTRUUA.

BY MR. ALFRED S. TAYLOR.

CASE 1.

A FEMALE, aged 25, was admitted into Guy's Hospital, May 17, 1836, under the care of Mr. Cooper, suffering from symptoms of poisoning by arsenic.

It appears, that, about four o'clock in the afternoon of that day, she had taken a quantity of arsenic; which, from her description, must have amounted to about forty grains. She procured it in a small lump; reduced it to a coarse powder, which she then loosely mixed with water; and in that state she swallowed it. In about an hour afterwards she became very ill, and vomited: she had pain in the stomach, great thirst, and a sense of constriction in the throat. A medical practitioner, who was called in, administered emetics and mucilaginous drinks, from which she experienced some relief. She became worse in the course of an hour or two, and was subsequently brought to the Hospital. This was about eleven o'clock in the evening, and, therefore, about seven hours after she had taken the poison. She was then labouring under the following symptoms:—the countenance was pale and anxious; the extremities were cold; there was occasional vomiting; *great thirst*; and the tongue was moist, but very red: *the pain in the stomach was not great, and not increased by pressure*: the pulse was 134, very irregular, but rather full: there was no pain in the head; and her mental faculties were unimpaired.

As she had, previously to her admission, taken emetics, which had acted freely, it was not thought necessary to resort to any further exhibition of them. A saponaceous

mixture, consisting of equal parts of oil and lime-water, was, however, thrown into the stomach, by means of the stomach-pump. This was for the purpose of enveloping any residuary particles of poison, and sheathing the coats of the organ from their influence. The stomach was first well washed out with this mixture; and then about three ounces of it, mixed with forty drops of tincture of opium, were injected into the organ, and allowed to remain there.

She was seen the following morning, at half-past one: she then complained of great thirst, but there was no increase of pain in the stomach. Her tongue was dry, and red: her extremities had become warm: there was no pain in the head. The heart was acting rapidly, but feebly; the pulse being about 132, small and feeble. After this, she obtained some rest for about an hour and a half; but she then became extremely restless, repeatedly calling for liquids. The thirst continued unabated until her death, which took place at a quarter past seven in the morning, a little more than *fifteen hours* after having taken the poison. Just before her death, her parents came to see her: she was then very restless, but perfectly *sensible*. She had sat up in bed, and was in the act of drinking; when she suddenly had a slight convulsive fit, and almost instantly died.

• The body was examined by Mr. King about eight hours after death. The thoracic viscera presented no appearances calling for notice; but the lining membrane of the bronchiæ was rather dark in colour, and congested.

On opening the abdomen, and exposing the cavity of the stomach, this organ was found to contain a dirty yellow-coloured liquid, somewhat tenacious, and holding, diffused through it, opaque grains of a white matter, evidently arsenic. Particles of the same substance, enveloped in mucus, were found scattered over the surface of the mucous membrane, in different parts. The appearances presented by the stomach, when seen and examined shortly after its removal, were as follows*. The mucous membrane was very rugose,

* A wax model of the stomach, representing very perfectly the morbid changes observed in it, has been made by Mr. Town. It is placed in the Museum, and numbered 2772^c.

especially at the larger extremity and inferior portion. The edges of the rugæ were, for the most part, vascular; whilst, in the intervening depressions, there were here and there dark-coloured patches of blood, extravasated beneath the mucous membrane. There was great vascularity of the membrane in the upper part of the organ; and there were three distinct lines, of a vermilion redness (the colour having become a little more intense by exposure), running parallel to each other, for nearly the whole of the interspace between the pyloric and the cardiac orifices. These lines terminated in a well-defined margin of redness, situated at the junction of the cardia with the œsophagus.

The most striking morbid changes, however, in the stomach existed near the larger curvature, towards the pyloric extremity. Here there was a large prominent oval patch of thickened membrane, about three inches in length, and two inches in breadth. This patch was, in the first instance, covered with a dense layer of opaque mucus, with difficulty separable, containing small granules of arsenic diffused in a white pasty mass. When the surface was washed, it was seen to be of a yellowish colour in the centre; and it was surrounded by a dark margin, as of extravasated blood. At this part, the coats of the stomach were at least three-quarters of an inch in thickness. There was no trace of ulceration or corrosion in any part of the mucous membrane. The peritoneal coat was slightly injected.

In the report of the examination, it is stated that the small intestines contained a great quantity of viscid mucus, tinged with bile. The duodenum was but slightly vascular; but the jejunum was in a high state of inflammation, in circumscribed patches, these portions of the mucous membrane being covered with an easily separable layer of mucus. The lining membrane of the last twelve inches of the ileum, as well as that of the cæcum, was slightly inflamed. The rest of the intestinal canal, with the other organs of the abdomen, presented no abnormal appearances. From the condition of the uterus and its appendages, there was reason to suspect that impregnation had recently taken place.

The head was not examined.

This case appears to me to be worthy of attention, in several points of view. The time at which the symptoms commenced, after the poison had been swallowed, was about the ordinary period; namely, *an hour*. The most remarkable circumstance, in their history, is, the general absence of pain throughout the progress of the case. It is true, that, in the first instance, there was pain in the stomach; but this soon abated, and did not afterwards return to any perceptible extent. In the generality of cases of poisoning by arsenic, pain is one of the most striking symptoms, especially in those in which the post-mortem inspection reveals such extensive changes in the stomach as were met with in this instance. In arsenical poisoning, also, the pain is commonly excruciating; being compared by the patient to a fire burning within the body*. It is, generally, much aggravated on pressure; and goes on increasing in intensity, with only occasional remissions, until the time of death: but here, these features were entirely wanting. Several instances are on record, in which this symptom of poisoning by arsenic has been absent; and we ought, therefore, in suspected cases, to be prepared for such an anomaly. Dr. Christison mentions an instance of this kind; and others are reported by Orfila†. In general, where the pain in the abdomen is slight, death takes place much more speedily; and the post-mortem changes are much less extensive than in the case before us. Dr. Christison has formed a separate group of these cases, constituting his second variety of poisoning by arsenic, in which symptoms of cerebral disturbance are often manifested. Here, however, it is to be observed, the mental faculties remained unimpaired till the last; and neither comatose symptoms nor convulsions manifested themselves during the progress of the case.

One of the most prominent symptoms under which the deceased laboured was the *extreme thirst*, which she in vain endeavoured to assuage by having constant recourse to liquids. I have noticed the presence of this symptom, to a

* Christison on Poisons, 217.

† Toxicologie Générale, Tome I. 384, 388, 397.

similar extent, in three other cases which have fallen under my observation. It certainly is not always present in arsenical poisoning; but, at the same time, I think too little notice has been taken of it by British toxicologists. One of our best writers on toxicology, Dr. Christison, mentions this symptom only in a cursory manner*. Continental medical jurists, however, attach full importance to this sign†; and Prof. Martini looks upon it, when conjoined with dryness and constriction of the fauces, as affording the most certain evidence of irritant poisoning‡. The other symptoms require no particular remark.

The treatment pursued was perhaps the best which, under the circumstances, could have been applied. The viscid mixture of oil and lime-water was well adapted to sheathe the coats of the stomach; and certainly, by more effectually enveloping and retaining the undissolved portions of the poison, to facilitate its removal by the stomach-pump, from the cavity of the organ. Lime-water has been proposed as a chemical antidote in poisoning by arsenic; but in the case before us, its mechanical operation, mixed with oil, was alone relied on. Lime, it is true, will combine with arsenious acid, and form an arsenite; but this arsenite is easily redissolved, either by a slight excess of the poison, or by the presence of a small quantity of acid, such as that which is ordinarily contained within the stomach. Besides, the arsenite of lime thus formed, like the other arsenites which are insoluble in water, is capable of acting deleteriously; so that the alleged antidotal powers of lime-water are now generally exploded.

Another point of interest, in a case of poisoning by arsenic, is the period at which death takes place. In that before us, the deceased died within the average period; which may be taken at from *six to twenty-four hours* after the ingestion of the poison, when the dose has been large. Many cases do not prove fatal until from twenty-four to

* Op. Cit. 216.

† Heuke's Lehrbuch der gerichtl. Medicin, 441. Vide also Meckel. Lehrb. der g. M. 216. Niemann's Taschenbuch d. S. A. 440.

‡ Introduzione alla Medicina Legale, Vol. II. 330.

forty-eight hours ; while, in some instances, the patient is destroyed in less than six hours. Taking the most severe cases of arsenical poisoning, however—of which this was one—the above may be assumed as the average period within which death will ensue. This question of the time at which arsenic proves fatal is, perhaps, not so interesting in a physiological, as in a medico-legal point of view ; but it is one for which a practitioner must be prepared. In a trial that took place at the Lewes Assizes, Autumn 1826, which is referred to by Dr. Christison*, the fact of the prisoners' guilt, of which the moral evidence left but little doubt, rested almost entirely upon the decision of this question. The deceased, it appears, died within *three hours* after the only meal at which the prisoners could have administered the poison (arsenic) to him : and one of the witnesses for the defence is reported to have assigned, among other reasons, why the deceased had not died from poison, that arsenic never destroys life within so short a period as three hours. Dr. Christison very properly censures so dogmatical an opinion ; and adduces many cases, to shew that life may be very rapidly destroyed by this poison. The shortest case, quoted by him from a German writer, proved fatal in *three hours*. There are numerous instances on record, in which life has been destroyed in from three to six hours after the taking of the poison : and I find an instance, reported by Meckel, in which death followed in *two hours and a half*†. A case of probable poisoning by arsenic is mentioned by Remer, which proved fatal within *half an hour* after the ingestion of the poison‡. Setting aside the last case referred to, we see that arsenic may destroy life within a very short period of time ; although it is comparatively rare to find it proving fatal in less than six hours.

In looking over the post-mortem appearances, we find the chief seat of mischief, as usual, in the stomach. The extreme degree to which inflammation of the mucous membrane of this organ had advanced, within the short period of fifteen hours, is, however, worthy of remark. The local

* On Poisons, p. 220.

† Lehrbuch der gerichtlichen Medicin, 218.

‡ Metzger System der gerichtlichen Arzneiwissenschaft, 256.

irritant action of the poison was here most strongly manifested; but there was neither ulceration nor gangrene. The effusion of dark blood beneath the mucous tunic has, perhaps, often given rise to the supposition of the existence of gangrenous spots in the stomach, in cases of arsenical poisoning. These patches of extravasation existed here chiefly in the interspaces of the rugæ, as well as around the raised oval portion of the stomach, at the pyloric extremity. The coats of the viscus were much thickened in the last-mentioned situation; a condition which does not appear to be very unfrequent; and perhaps, on the whole, is a much more common morbid change from arsenic, than perforation. Metzger met with this thickened state of the coats of the stomach*; and Pyl reports a case, in which the parietes of the viscus had twice their usual thickness†.

Lastly, it remains for me to describe the plan pursued for the identification of the poison. The confession made by the deceased, as well as the nature of the symptoms, left but little doubt that arsenic had been taken: but a case is always rendered more satisfactory when, to these sources of evidence, we can add the certainty commonly derivable from chemical analysis.

Knowing that the poison had been swallowed in the state of a coarse powder, I considered it not unlikely that some undissolved particles might exist in the contents of the stomach. The liquid found in this organ was of a yellowish colour, and of thick gruelly consistency, containing, diffused through it, lumps of coagulated matter. A portion of this liquid was diluted with warm distilled water, placed in a glass vessel tapering to a point at the bottom, and then violently shaken. After waiting a minute, the liquid was rapidly poured off into a dish; and at the bottom of the glass, numerous hard masses, apparently of arsenious acid, slightly discoloured, were found. These were picked out, dried, and heated with black flux; when several well-defined rings of metallic arsenic were obtained. This process of separating arsenious acid, by its great specific gravity, I have often found to answer, where the viscosity of the liquid, con-

* Metzger *System der gerichtlichen Arseneiwissenschaft*, 256.

† *Ansätze und Beobachtungen*, I. 58.

taining it, had been removed by the addition of distilled water. In this way, the examiner may frequently save himself a great deal of trouble and research.

Another portion of the contents of the stomach, diluted with distilled water, and well acidulated with acetic acid, was now boiled for two hours. It was filtered, while hot, through fine muslin, and afterwards through paper: this, owing to the abundance of organic matter, was a very slow process. The liquid obtained by this second filtration was still turbid; but it contained comparatively little organic matter, although sufficient to prevent entirely the application of the silver and copper tests. The filtered liquid was now divided into two portions. Into the first, after it had been acidulated with acetic acid, sulphuretted hydrogen gas was passed, to saturation: a golden-yellow coloured compound was speedily formed, which slowly subsided, after boiling the solution to drive off any excess of the gas. The precipitate thus obtained was proved to be sesquisulphuret of arsenic: 1st, by its insolubility in the mineral acids; 2dly, by its perfect solubility in strong liquor ammoniæ; and, 3dly, by its yielding a ring of metallic arsenic, when slowly heated with four times its weight of black flux. The precipitated sesquisulphuret was combined with a portion of extraneous matter; but I have never found this an obstacle to the determination of its true chemical characters, except when the foreign matter has been in unusually large quantity. The sesquisulphuret is not so easily reduced to the metallic state as arsenious acid: it requires a larger quantity of flux; and it is, perhaps, better to use a lower heat, and to apply it more slowly, than in the case of arsenious acid.

The second portion of filtered liquid, having been slightly reduced in bulk by evaporation, was now treated with an excess of alcohol, and introduced into the ingenious apparatus which had been then but recently proposed, by Mr. Marsh of Woolwich, for the detection of minute quantities of arsenic. The principle of this discovery is, to generate hydrogen gas slowly in the midst of a liquid containing any arsenious or arsenic acid, or any of the soluble salts formed by the union of these acids with bases. In all of these instances, the nascent hydrogen combines with the *metallic arsenic*, resulting from the decomposition of the acid or salt;

and forms a gas well known as the arseniuretted hydrogen. This gas is generated under the pressure of a column of water, in a glass tube bent upon itself; so that the two legs (*a*, *b*), one of which is only half the length of the other, are parallel. The shorter leg (*a*) is provided with a stop-cock (*c*); and it is in this leg that the gas is produced, by dropping a piece of metallic zinc into the suspected poisonous liquid previously acidulated with sulphuric acid. When the arseniuretted hydrogen has collected so as to fill the shorter leg of the tube, it is allowed to escape from the stop-cock; and at this moment, if a lighted taper be applied, it will burn with a dull white flame: and if, at the same instant, a

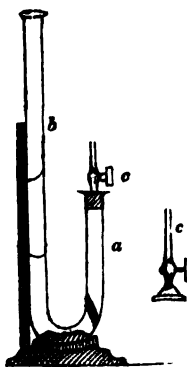


plate of clean glass be brought over the flame, a circular stain of metallic arsenic is formed upon it; whilst the combustion of the hydrogen, at the same time, produces a ring of aqueous vapour around the metallic stain. In some instances, the quantity of arsenic deposited in the metallic state is such, that a perfect leaf of the metal may be raised from the surface of the glass*.

In the case before us, upwards of twenty crusts of metallic arsenic were produced from about three drachms of the filtered liquid, treated with alcohol. The object of using

* Several objections have been urged against the use of this, which may be called, the "Hydrogen Test." They may be reduced to two: 1. That arsenic is sometimes contained in the sulphuric acid of commerce, and often in metallic zinc.—This objection is at once removed, by trying the experiment, in the first instance, with zinc, sulphuric acid, and distilled water:—if arsenic be present in either of the bodies, a stain will be left on a plate of glass, in burning the gas: if not, there will be merely a deposit of pure water. In the former case, purer materials must be sought for; and these it will not commonly be difficult to find. 2. Other bodies may combine with hydrogen, and, during combustion, be deposited on glass. The plain and obvious answer to this objection is this: Let the sublimate be treated with dilute nitric acid, and then allow a current of sulphuretted hydrogen gas to pass over it. If the sublimate be arsenic, the yellow sesquisulphuret will be immediately produced, soluble in *Liquor Ammonia*. This corroborative experiment must suffice to remove all doubt respecting the nature of the sublimate. I have found this test effectual in cases where the sulphuretted hydrogen gas has failed to indicate the least trace of arsenious acid. During the last six months, I have performed many experiments with this apparatus, both on artificial mixtures, and on the contents of stomachs of persons poisoned by arsenic. In respect to its delicacy, I have obtained sublimate from $\frac{1}{100}$ gr. of arsenious acid, diffused in 45,000 parts of water.

alcohol, is to prevent the frothing of the liquid within the tube, which, in a mixture containing organic matter, is very likely to occur; and when this does occur, it interferes with the free escape and combustion of the gas. The precise nature of the sublimate was determined by the corroborative experiment mentioned in the note.

The contents of a portion of the jejunum, which had been insulated for the purpose of examination, were now submitted to analysis by the same processes, and with equally satisfactory results. The hydrogen test shewed that arsenic was abundantly present in the fluids of this part of the alimentary canal.

CASE 2.*

This was also the case of a female, aged 22, who was admitted Sept. 3, 1836, at nine o'clock in the evening. She was reported to have taken, an hour before her admission, an ounce of arsenious acid, in consequence of some disappointment. Ineffectual attempts had already been made to induce her to take emetics; but vomiting had occurred from the action of the poison. When admitted, the surface was cold; her pulse was small and quick; and the matters ejected from the stomach by vomiting, consisted chiefly of mucus, slightly streaked with blood. The stomach-pump was immediately applied, and the stomach well washed out. Albumen was then exhibited, followed by an emetic of the sulphate of zinc; and, in order to keep up the action of the stomach, warm water was freely administered at intervals. During this time, violent diarrhœa supervened, from the effect of the poison.

At twelve o'clock P.M., three hours after her admission, the following were the symptoms:—coldness of the surface; depression of the countenance; restlessness; lividity of the lips; glaziness of the eyes; a rapid, feeble, and irregular pulse; pain in the abdomen, materially increased by pressure, especially in the epigastric region; occasional vomiting of mucus tinged with blood; the respiration was somewhat accelerated, and accompanied by frequent sighing. The

* For the substance of this report I am indebted to Mr. James Godfrey.

diarrhœa had at this time ceased, and there was a slight tendency to coma.

She was seen again about four hours afterwards, when all the above symptoms had rather increased, and she was affected with cramps in the legs. At eight o'clock on the 4th, vomiting had ceased; the pulse at the wrist was imperceptible; the symptoms of coma had increased; but she was still very restless. At ten o'clock, this restlessness subsided; she became quiet; the action of the heart was failing; the respiration was laborious; and she died at one o'clock, about *seventeen* hours after having taken the poison.

The inspection of the body took place twenty-six hours after death; and the following were the principal appearances. The mucous membrane of the stomach was highly inflamed throughout, and was in many parts *ulcerated*. The rugæ of the membrane were not very numerous, but their summits were especially the seat of inflammation and ulceration. No *arsenic* was found in the stomach, nor were there any solid matters present.

The mucous membrane of the duodenum was much inflamed, and there were also considerable patches of inflammation and ulceration on that of the ileum. The mucous membrane of the colon was slightly injected, as well as that of the rectum; but there was no trace of poison to be discovered in the last-mentioned portion of the intestinal canal. The œsophagus was likewise inflamed, and the lining membrane of the larynx and trachea was highly injected. The uterus exhibited evidence of existing menstruation.

The history of this case does not differ from that generally detailed of the most severe forms of poisoning by arsenic. There is but little peculiarity in the progress of the symptoms, or in the post-mortem appearances. There was certainly an absence of thirst, in which respect this case differs from the preceding; and there was also a *tendency to coma*, indicating the remote effect of this poison upon the brain. This symptom, however, as indeed it has been generally remarked by toxicologists, did not make its appearance until the violent irritation in the alimentary canal had, in

great part, subsided. Death took place within the average period of time.

The summits of the rugæ in the stomach were in this, as in the former case, especially inflamed. This is what I believe to be very common, where the mucous membrane is at all inflamed. It appears to proceed from these prominent portions of the membrane, coming more directly in contact with the particles of the poison. There was, however, one appearance here, which was not observed in Case 1; namely, extensive ulceration of the mucous coat. My own observation, in the few cases in which I have had an opportunity of making a post-mortem examination, agrees with that of Dr. Christison; namely, that ulceration is not a very common morbid change from poisoning by arsenic*. Dr. Christison remarks, that "death frequently takes place, before that process *can be established*:" and says, that, "for the most part, it is hardly to be looked for, unless the patient has survived nearly *two days*." We may observe, however, that the inflammation produced by an irritant poison, like arsenic, does not follow exactly the same laws as that which is termed 'healthy inflammation,' in surgery. The action of the poison is specific. The inflammatory condition of the stomach may be more rapidly induced, and the consequences of that inflammation more speedily manifested. Although, then, ulceration of the stomach, as an effect of arsenical poisoning, is not common, yet this case proves, that the process may be certainly perfectly established, both in this organ as well as in the intestines, when the poison has operated fatally within so short a period as *seventeen hours*.

There is another point worthy of remark in the account of the inspection; namely, that not a trace of the poison could be discovered in the stomach. This is to be regarded as the more singular, when it is considered that *an ounce* of the powder was taken; that the deceased lived only *seventeen hours*; and that the arsenious acid, of all poisons, is most liable to become enveloped in mucus, and locked up within the folds of the mucous membrane. One

* On Poisons, 247.

or two cases are recorded by Dr. Christison somewhat similar, in relation to this point*. The fact appears to me readily to admit of explanation, from the abundant vomiting, and from the diarrhœa, with which the deceased was affected; by either or both of which, it is well known, a mineral poison may be readily expelled from the body. It must also be borne in mind, that the stomach was well washed out with the stomach-pump: and this fact of the absence of the poison from the cavity of the organ after death, may perhaps be here adduced, to shew that that instrument may be sometimes very efficaciously employed in cases of arsenical poisoning. The result of this case will also enable a practitioner to give a decided answer to a question sometimes put in a Court of Law—"Whether the non-discovery of poison in the stomach, *when death has speedily taken place*, should be regarded as a proof that the individual has not been poisoned?" The records of medical experience will furnish a few such cases as this; but the more they are accumulated, the more satisfactory does medical evidence, founded upon them, become. Ulceration of the mucous membrane of the intestines is not very commonly seen in cases of poisoning by arsenic, except when a fatal result has been for some time deferred. In this instance, there were patches of ulceration in the ileum, especially around the seats of the glandulæ aggregatæ.

This case also shews to us how very extensively the mucous membranes of the body may be affected by the action of arsenic. The lining membrane of the larynx and trachea †, that of the œsophagus, and indeed of nearly the whole course of the alimentary canal to the rectum, was, in places, more or less injected, inflamed, or ulcerated. The changes in the rectum were but slight: they did not amount to ulceration.

Arsenic has been observed, in some instances, to have a singular effect on the menstrual function. Schweickhard met with a fatal case of poisoning by arsenic, in which the

* On Poisons, 49, 249.

† An inflammatory redness of the air-passages is said to be somewhat rare, as an effect of poisoning by arsenic.

secretion, after having ceased eight days, was suddenly restored. On making an inspection of the body, the organs of generation were found inflamed. A precisely similar case occurred to Hasenest *. In the instance before us, it does not appear that there took place any increased secretion from the effects of the poison.

That arsenic was the substance which the deceased had taken was proved by an analysis of some of the matter which she had vomited on her admission, conducted by Mr. Godfrey. This gentleman, however, kindly furnished me with two portions of liquid which had been removed from the stomach of the deceased, by the stomach-pump, at two different periods before her death. The process of analysis pursued with respect to these, was as follows:—The first liquid examined, appeared to consist of nothing more than water, with small brownish-coloured masses loosely diffused through it, which, when the vessel was agitated, and then allowed to stand, rapidly sank to the bottom. This liquid was filtered, and the undissolved residue collected and dried. The residue, when heated with black flux, yielded an abundant sublimate of metallic arsenic. The filtered liquid gave but a very faint re-action with the tests for arsenic. There was evidently but a very minute portion of poison dissolved in it.

The second liquid, which was next submitted to analysis, amounted to about two ounces: it was opaque, frothy, and viscid, containing, suspended in it, numerous flakes of coagulated albumen. After dilution with distilled water, it was treated with acetic acid, and boiled for about two hours; the waste by evaporation being made up. It was then filtered, and divided into two portions. Into one, sulphuretted hydrogen gas was passed for some time; which gave rise to a very copious white precipitate, indicating the presence of a salt of zinc. Accordingly, a portion, on being submitted to further analysis, was found to contain a very

* Meckel, *Lehrbuch der gerichtlichen Medicin*, 217.

large quantity of the sulphate of zinc. The precipitate formed by sulphuretted hydrogen had no tinge of yellow : consequently, it might have been inferred that arsenic was not present. But on a part of the filtered liquid being submitted to the action of the "hydrogen test," sublimes of metallic arsenic were obtained. These, it is true, were extremely slight : one of them, when tried, was not ponderable in a balance turning with the hundredth of a grain. The quantity obtained, however, was sufficient to shew that arsenic was really present ; which, without the application of Mr. Marsh's apparatus, I do not think it would have been possible for an experimentalist to have declared.

Neither the copper nor the silver test was employed in this investigation. Indeed, I have long acted on the principle of never employing these tests, except when operating upon a clear solution of the poison, in which there is certainly no organic matter, nor any foreign salt, alkaline or metallic. The common alkaline and earthy salts do not in the least interfere with the action of sulphuretted hydrogen gas on arsenious acid ; but their presence materially counteracts or modifies the effects of the copper and silver reagents. Thus, muriate of soda is very likely to be found in the human stomach, mixed with arsenic : this salt not only destroys the action of the silver test, but renders that of the copper ambiguous. Very complicated directions are given by some writers for the purpose of removing this substance from a mixture of arsenious acid containing it, before the application of the tests in question : but there is no necessity whatever for following these directions ; since, setting aside the valuable application of the hydrogen test, the action of sulphuretted hydrogen, with the subsequent reduction of the precipitated sulphuret, must furnish the practitioner with such evidence, that the seeking for further corroborative re-actions would only be a work of supererogation. I have found that the presence of a very minute portion of arsenious acid, dissolved in a large quantity of a saturated solution of muriate of soda, was detected by sulphuretted hydrogen, with the same facility as if it had been dissolved in water.

There is one case in which the sulphuretted hydrogen may fail ; and we have an exemplification of it in the chemical

analysis just gives; namely, where a metallic salt is mixed up with the contents of the stomach, in cases of arsenical poisoning. The sulphates of copper and zinc, and tartarized antimony, are so frequently resorted to as emetics, that the practitioner ought to be prepared for occasional ambiguity, in the re-action of sulphuretted hydrogen. In the second case reported, sulphate of zinc had been given; and nothing but a sulphuret of that metal could be obtained, in operating on the contents with sulphuretted hydrogen gas. So, if a compound poison were ever exhibited or taken—as, for instance, a mixture of arsenic and corrosive sublimate—the process of analysis might be seriously embarrassed, unless the operator were prepared with a knowledge of the effects of sulphuretted hydrogen on particular metallic salts. In admitting, however, that the results of the application of sulphuretted hydrogen are not always clear and satisfactory, we must remember, that we have now in our hands a means of demonstrating the presence of arsenic, in whatever state of admixture with other substances it may be. By the use of the hydrogen apparatus, the smallest quantities of arsenious acid, when mixed up with corrosive sublimate, sulphate of zinc, sulphate of copper, tartarized antimony, or other metallic poisons, in large proportions, may be detected with the same facility and certainty, as if those salts were absent.

REMARKS ON THE SOLUBILITY OF ARSENIOS ACID IN WATER AND OTHER MENSTRUUA.

The solubility of arsenic in water at different temperatures has been variously stated. In general, chemists and medical jurists have relied upon the results obtained by M. Guibourt; but it seems to me, that these results have been somewhat hastily adopted. The action of water on arsenious acid is, in some respects, peculiar. Under any circumstances, the affinity between the two bodies is extremely slight: at *low* temperatures, even when they are allowed to remain in contact many hours and the vessel is frequently agitated, but a very minute portion of the poison is dissolved: at *high* temperatures, *i.e.* when boiling water is poured on the poison, and allowed to cool over it, the quan-

tity dissolved, although greater than in the preceding cases, is extremely small; and much less than the quantity retained in a cold saturated solution, prepared by boiling together, for several hours, the arsenic and water. When a solution is made by gradually adding arsenious acid to water kept boiling for an hour, the proportion taken up is greater as the boiling continues, at least for the first half hour. On removing the vessel from the fire, and allowing it to stand for a few minutes only, a considerable imperfectly-crystalline deposit takes place: this deposit rapidly increases as the liquid cools, so that about one half of the arsenic falls down in octohedral crystals, after the lapse of seventy-two hours. The mere admixture of arsenic and boiling water is not then sufficient, as in the case of most soluble bodies, to bring about a combination: it is necessary that the poison should be for some time boiled in water, before perfect solution can be effected: the mere application of a heat of 212° , with subsequent cooling, is ineffectual for this purpose.

Several explanations have been offered, to account for this seeming anomaly in the phenomena of solution. Fischer, a German chemist, conceived, that during the process of boiling, the arsenious acid underwent some change; although he confessed that he was unable to discover any difference in the composition of the crystals which were separated on cooling*. He imagined that one portion of the arsenious acid might surrender a part of its oxygen to another portion, by which the latter would acquire a higher degree of acidification, and be rendered more soluble; while the de-oxidized portion would become, in the same ratio, less soluble. It is, indeed, stated by him, that the arsenious acid, separated by crystallization from a boiling saturated solution on cooling, has only one-twentieth of the solubility of this substance, as it is ordinarily met with. He also notices the change of colour which the arsenic undergoes; and considers this, as affording evidence of the process of ebullition having brought about some chemical change in

* Remer's *Lehrbuch der Polizeilich-gerichtlichen Chemie*, 2^{ter} Band, p. 714.

this body. With regard to the impaired solubility of the crystallized arsenious acid procured in the manner above stated, so far from obtaining the extraordinary result mentioned by this chemist, I have not been able to observe any other difference, when the crystals had been previously reduced to powder, than that the boiling required to be kept up for a longer period. It appears to me, that the force of cohesion in the crystalline particles is the main obstacle to the free solution of this substance, under these circumstances. The change of colour in arsenious acid—for the crystals have invariably a dusky brown or yellowish colour—is perhaps easily explicable, on the principle, that the arrangement of the particles is different in the crystalline and amorphous states.

- That the increased solubility of arsenious acid by long boiling is not due to any transference of oxygen from one portion to another*, is, I think, evident, from numerous circumstances: — 1. There is no difference in the chemical composition of the crystals and of the amorphous powder. 2. A portion of the clear solution (procured by long boiling), evaporated to dryness, leaves a residue, which, when heated on platina to about 400°, by means of a spirit-lamp, is entirely volatilized. Now any portion of arsenic acid, existing in this residue, would be at once discovered, by its remaining fixed at the temperature which a spirit-lamp is capable of affording. 3. The dried residue, obtained in the manner just stated, is in no respect deliquescent; while the arsenic acid speedily passes to the liquid state, when exposed to air. 4. The nitrate of silver gives no precipitate with the clear solution of arsenious acid after boiling and filtration, (when the two solutions are in a highly concentrated state, there is a milkiness produced;) while this re-agent throws down the smallest quantity of arsenic acid, if mixed with arsenious acid, of a *brick-red* colour. Arsenious acid, then, does not undergo, during ebullition, any chemical change, by which its degree of acidification becomes altered. We know that the effect of heat, in rendering solids more soluble in water, is due to this agent increasing the force of affinity between the

* Brande's Manual of Chemistry, Vol. II. 114.

solid and the liquid. With some bodies—and arsenious acid is a direct instance of this—it is necessary that the heat *should be for some time applied*, in order that the affinity of water for this body should be raised to its maximum degree.

Before proceeding to detail my own experiments on the solubility of this poison in water, I shall quote the observations of other experimentalists; reducing them, for the sake of comparison, to one standard; and always presuming, unless the contrary be expressed, that a thousand parts of water have been used*.

Klaproth.

This chemist was one of the first who experimented on the subject: according to him,

| | |
|---|---------------------------|
| 1000 parts of water, at 60°, dissolve of arsenious acid | 2. 5 or $\frac{1}{200}$. |
| 1000 212° | 77.75 or $\frac{1}{13}$. |

By this, it appears that arsenious acid is thirty times more soluble in boiling, than in temperate water. Klaproth further observed, that one thousand parts of the boiling solution, after having stood three days, retained only thirty parts of arsenious acid, about $\frac{1}{33}$ —or twelve times as much, as was taken up by water *at the same temperature*, without boiling †.

Bucholz.

Bucholz confirmed, in some respects, Klaproth's experiments. He was also the first chemist who described a difference in the solubility of the varieties of arsenious acid; and he found that, *cæteris paribus*, more arsenic, proportionally, was dissolved, when a large quantity was introduced into water at once, than when a small quantity only was present. This experimentalist determined, with regard to the solubility of arsenious acid, that,

| | |
|--|--------------------------|
| 1000 parts of water, at 50° dissolve . . | 15 or $\frac{1}{66}$. |
| 1000 at 65° | 20 or $\frac{1}{50}$. |
| 1000 at 140° | 45.4 or $\frac{1}{22}$. |
| 1000 at 212° | 81 or $\frac{1}{12}$. |

The result, with regard to boiling water, differs but little from that obtained by Klaproth: but there is a material difference relative to the solvent power of temperate water,

* 1000 gr. of water correspond to two fluid ounces of the measure here used; but two fluid ounces of the new pharmacopœial measure are equal to 875 gr.

† Beiträge zur chemischen Kenntniss der Mineralkörper. *Berlin*, 1815.

which can only be partially explained away, by supposing that Bucholz is speaking of the quantity of arsenic retained at that temperature, after the liquid has been boiled *.

Fischer.

Fischer proved how much ambiguity was connected with this subject, by demonstrating, that, even when the quantities of arsenic and water were taken in the ratio of the solubility of the former, or when even a less proportion of arsenic had been taken, it was not always possible to effect a perfect solution. He states, that at ordinary temperatures he could not procure a stronger solution, than that indicated by the respective quantities below. In digesting one part of arsenious acid in eighty parts of water, he found that the solvent did not take up more than one ninetieth of its weight †. Thus,

| | |
|--|------------------|
| 80 parts water, at 60°, dissolve . . . | $\frac{1}{99}$ |
| 160 | $\frac{1}{198}$ |
| 240 | $\frac{1}{297}$ |
| 1000 | $\frac{1}{1980}$ |

Remer.

This writer remarks, that most experimentalists have found arsenic to be soluble in eighty parts of cold, and in fifteen parts of boiling water. He has, however, brought together the results of several observers, in order to shew the discrepancy which exists ‡:—

| | |
|---|--------------------------|
| Hahnemann found that 1000 parts water, at 96°, dissolved 10.4 or $\frac{1}{97}$. | |
| Spielmann 50° . . . | 10.4 or $\frac{1}{98}$. |
| De la Métherie 212° . . . | 41.6 or $\frac{1}{24}$. |
| Beaumé 212° . . . | 15.6 or $\frac{1}{64}$. |
| Vogel 212° . . . | 16.6 or $\frac{1}{60}$. |
| Navier 212° . . . | 12.5 or $\frac{1}{80}$. |
| Nasse 212° . . . | 5. or $\frac{1}{100}$. |

In one of the most recent German works on Chemistry, Professor Von Jacquin of Vienna merely quotes the experiments of Guibourt, which will be hereafter given §.

* Remer's Polizeilich-gerichtlichen Chemie, 2^{ter} Band, 715.

† Berzelius Traité de Chimie, T. II. p. 429.

‡ Op. cit. loc. cit.

§ Grundsätze der allgemeinen und medicinischen Chemie, 1^{ter} Band, 271. Wien, 1836.

La Grange.*

| | |
|--|--------------------------|
| 1000 parts water, at 60°, dissolve . . . | 41.6 or $\frac{1}{24}$. |
| 1000 212° | 66.6 or $\frac{1}{15}$. |

Berzelius.

Berzelius's remarks upon this subject are very few. He somewhat vaguely states, that when a solution of arsenious acid is about to crystallize, it contains from $\frac{1}{15}$ to $\frac{1}{25}$ of its weight of arsenic dissolved. According to this, therefore,

1000 parts water, cooled from 212°, dissolve 80 parts.

This distinguished chemist chiefly relies upon the experiments of Guibourt †.

Dumas

states the observations of Guibourt †.

Despretz

gives, for the solubility of arsenious acid in cold water, $\frac{1}{30}$; and adds, it is much more soluble in hot water. According to this,

1000 parts water, at 60°, dissolve 50 parts, or $\frac{1}{20}$.

Although it is not stated, it is possible that this chemist is speaking of a solution which has been boiled and allowed to cool. It has been already observed, that cold water will not dissolve a quantity, which water cooled from long boiling with arsenious acid will readily retain §.

Orfila|| and Devergie¶ quote the experiments of Guibourt; and Bouchardat** quotes the remarks of Berzelius.

Thénard, after having stated Guibourt's experiments, observes, that a solution of arsenic is easily procured by boiling it in water. On cooling, a portion is precipitated

* Henry's Elements of Experimental Chemistry, Vol. II. 51.

† Traité de Chimie, II. 430.

‡ Traité de Chimie, appliquée aux Arts, I. 355.

§ Elémens de Chimie, I. 252.

|| Elémens de Chimie, I. 559.

¶ Médecine Légale, II. 716.

** Cours de Chimie Elémentaire, I. 193.

in *tetrahedral* crystals, nearly opaque. The solution, according to him, has no action on vegetable blue colours*.

This last observation must have been made from the employment of a kind of litmus paper, not very susceptible of slight acid re-action.

Guibourt.

The results obtained by this experimentalist are detailed in most works on Chemistry and Medical Jurisprudence: a very complete account of them will be found in the treatises of Berzelius and Dumas. Guibourt noticed a difference in the solubility of the opaque and transparent varieties of arsenious acid, as also a difference in their specific gravities. With regard to the latter point, he found the specific gravity of the opaque kind (common arsenic) to be 3.699; while that of the transparent variety was 3.7385. He states, that the opaque is much more soluble than the transparent variety;—that the latter alone has an acid reaction in solution; while the former possesses the property of rendering reddened litmus paper, blue; a circumstance which he considered to be owing to its containing ammonia, although he could not detect that alkali in it. His results, with respect to the solubility of the opaque variety of arsenic, are as follows:—

| | |
|---|--------------------------|
| 1000 parts water, at 60°, dissolve | 12.5 or $\frac{1}{8}$. |
| 1000 212° | 114.7 or $\frac{1}{4}$. |
| 1000 212° cooled to 60°, retain | 29. or $\frac{1}{34}$. |

So far as I have been able to ascertain, no English chemist has yet made a series of experiments on this subject.

Mr. Brande†, Dr. Paris‡, and Dr. A. T. Thompson§, give

* *Traité de Chimie*, II. 361. Thénard describes the crystals as opaque; but this must have arisen from his having confined his observations to the semi-crystalline mass, which is rapidly deposited from a boiling concentrated solution, on its beginning to cool. With regard to the form of the crystals, Thénard, and a few other chemists, state them to be tetrahedral: but by far the greater number of experimentalists describe them as octohedral. In examining the crystalline deposit with high and common magnifying powers, the crystals have always appeared to me to have the form of octohedra. Brande states, that both octohedral and tetrahedral crystals are deposited.

† *Manual of Chemistry*, II. 114.

‡ *Medical Jurisprudence*, II. 215.

§ *London Dispensatory*, 171.

the results of Klaproth. Dr. Henry*, those of Bucholz and La Grange. Dra. Turner† and Christison‡, those of Klaproth and Guibourt; while Dr. Ure§ takes the experiments of Guibourt for temperate water, and those of Klaproth for water at 212°. In another part of his paper, however, this latter chemist says, that,

| | | |
|--|---------------------|---------------------------|
| 1000 parts water, at 60°, dissolve . . . | 3. | or $\frac{1}{333}$. |
| 1000 212° | 72. | or $\frac{1}{14}$ nearly. |
| 1000 212° cooled, retain 30. | or $\frac{1}{33}$. | |

These results differ but slightly from those of Klaproth.

Summary of Results.

1.

One thousand parts of temperate water dissolve, of their weight of arsenious acid, according to—

| | | | | |
|------------------|-------------------|-----------------|------------------|-------------------|
| <i>Despretz,</i> | <i>La Grange,</i> | <i>Bucholz,</i> | <i>Guibourt,</i> | <i>Hahnemann,</i> |
| $\frac{1}{20}$ | $\frac{1}{24}$ | $\frac{1}{30}$ | $\frac{1}{80}$ | $\frac{1}{96}$ |
| | <i>Spielmann,</i> | <i>Ure,</i> | <i>Klaproth,</i> | <i>Fischer,</i> |
| | $\frac{1}{98}$ | $\frac{1}{333}$ | $\frac{1}{60}$ | $\frac{1}{1200}$ |

The results of some of these experimentalists were probably obtained by boiling the water on arsenious acid, allowing the solution to cool, and then estimating the quantity dissolved; while those of others were probably deduced from the actual digestion of the poison in cold water. It is perhaps in this way, that we may reconcile the enormous difference between the statements of Despretz and Fischer; the former making arsenic sixty times more soluble than the latter.

2.

One thousand parts of boiling water dissolve, of their weight of arsenious acid, according to

| | | | | | |
|------------------|-----------------|------------------|----------------|-------------------|------------------------|
| <i>Guibourt,</i> | <i>Bucholz,</i> | <i>Klaproth,</i> | <i>Ure,</i> | <i>La Grange,</i> | <i>De la Méthérie,</i> |
| $\frac{1}{8}$ | $\frac{1}{12}$ | $\frac{1}{13}$ | $\frac{1}{14}$ | $\frac{1}{15}$ | $\frac{1}{24}$ |
| | <i>Vogel,</i> | <i>Beaumé,</i> | <i>Navier,</i> | <i>Nasse,</i> | |
| | $\frac{1}{60}$ | $\frac{1}{84}$ | $\frac{1}{80}$ | $\frac{1}{100}$ | |

The differences in this table may perhaps be explained, by supposing that a heat of 212° may have been applied for

* Elements of Chemistry, II. 52.

† Elements of Chemistry, 531.

‡ Treatise on Poisons, 177.

§ Chemical Dictionary—Acid Arsenious.

different periods of time ; as also, that specimens of arsenious acid, probably varying considerably in their degree of solubility, may have been employed.

It was the discovery of these very different results, respecting the solubility of arsenic by men of well-known authority as chemists, that first induced me to endeavour to ascertain which statement was borne out by experiment.

In relation to specific gravity, I found that of a mass of arsenious acid which had been kept four years, and was perfectly *opaque*—presenting, when fractured, a slightly crystalline structure—to be 3.529. Having procured a recently-prepared specimen, perfectly *transparent*, but of a slightly-yellowish tinge, I tried its specific gravity, and found it to be 3.798.

Arsenious acid, it may be remarked, is soluble in water, oils, and alcohol. Water is its most common solvent ; and it is, therefore, of its solubility in this menstruum that I shall first proceed to speak. The water employed in the experiments mentioned below, was the common water of the Hospital ; which is the Thames water, filtered. It contains, comparatively, little foreign matter. A given measure of this water weighed 752.7 gr. ; while the same measure of recently distilled water weighed 752 gr. Its specific gravity will, therefore, be 1.00093. Distilled water was not employed in these experiments, since I had a medico-legal object in view : in no case of criminal poisoning, is it likely that distilled water will be used by the suicide or murderer. In the course of many experiments, however, there did not appear to me to be the least appreciable difference in the solvent power of water over arsenious acid, whether distilled, or common river-water filtered, was employed.

Exp. 1.

Twenty grains of opaque arsenious acid, reduced to a fine powder, were placed in a clean glass vessel, and eight fluid ounces of *boiling water* were poured on. A portion of the powder collected into small lumps, which floated, and, even after violent agitation, adhered to the sides of the vessel ; while another portion sank to the bottom. The vessel remained covered *seventy-two hours* ; the contents being

frequently agitated, to insure perfect contact and admixture. The water was then carefully filtered, and the filter dried. The residuary undissolved powder weighed 10.46 gr. Therefore,

$20 - 10.46 = 9.54$ gr. dissolved by $f \frac{3}{4}$ viij. or $(500 \times 8) 4000$ gr. water,
and $4000 \div 9.54 = 419$; as also, $9.54 \div 4 = 2.385$ gr.

Hence,

1000 parts water at 212° , dissolved 2.385 pts. or $\frac{1}{13}$.

EXP. 2.

A similar experiment was performed; and the residuary powder obtained on the filter, weighed 9.27 gr. Therefore,

$20 - 9.27 = 10.73$, dissolved by $f \frac{3}{4}$ viij. or $(500 \times 8) 4000$ gr. water;
and $4000 \div 10.73 = 372$; as also, $10.73 \div 4 = 2.6825$ gr.

Hence,

1000 parts water at 212° , dissolved 2.6825 gr. or $\frac{1}{13}$.

Twenty-five grains of each of these solutions, filtered, were now evaporated to dryness, at a low temperature; and .06 gr. were obtained as the mean weight of the residue of several successive evaporations of Exp. 1.; and .07 as the mean for Exp. 2; results which come as near to the proportions above ascertained, as could be well expected, considering that distilled water was not employed.

The mean of the Exps. 1 and 2 will be the following: 1000 gr. of boiling water, allowed to cool, and remain 72 hours (with frequent agitation), on 20 gr. arsenious acid, will dissolve 2.53 gr., or about $\frac{1}{8}$ of their weight.

EXP. 3.

Two ounces of water were kept *gently* boiling for an hour, the waste by evaporation being made up; and while boiling, finely powdered arsenious acid, in small quantities at a time, was gradually added, from a previously weighed quantity. No further portion was added, until that which had been previously added, was dissolved. The result was, that,

1000 gr. of water ($f \frac{3}{4}$ ij.) dissolved 31.5 gr. or $\frac{1}{3}$.

This solution was placed aside for 72 hours; and at the end of that time, it was found to have deposited in brown octohedral crystals, 14.5 gr.; and $31.5 - 14.5 = 17$ gr. Hence, 1000 grains water ($f \frac{3}{4}$ ij.) held dissolved, on perfect cooling, 17 grains, or $\frac{1}{3}$. Twenty-five grains of the cold solution were slowly evaporated to dryness; and the mean of several evaporations

gave .41 gr. as a residue, which is a little below the proportion as above ascertained.

EXP. 4.

Two ounces of water were kept *violently* boiling for an hour, the waste by evaporation being made up; and arsenious acid was gradually added from a weighed quantity, as before. It was then found, that

1000 gr. of water had dissolved 46.3 or $\frac{1}{2}$.

From this solution, there were deposited in crystals, after 72 hours, 21.6 gr. and $46.3 - 21.6 = 24.7$ gr.

1000 gr. water held dissolved, on perfect cooling, 24.7 gr. or $\frac{1}{4}$.

Twenty-five grains of the cold solution, evaporated, left .55 gr., rather less than the proportion deduced from the weight of the undissolved residue.

EXP. 5.

In this experiment, four ounces of water were kept *violently* boiling for half an hour; arsenious acid being added, as before, from a weighed quantity. 89 gr. were dissolved. Hence,

1000 gr. water dissolved $(89 \div 2)$ 44.5 gr. or about $\frac{1}{3}$.

The mean of Exps. 3, 4, and 5, will be the following:

1000 gr. of boiling water dissolve 40.76 gr. or $\frac{1}{4}$.

The *rapidity* of boiling will make a considerable difference in the quantity dissolved, as will be seen on comparing Exps. 3 and 4. Indeed, water which boils violently will dissolve as much arsenic in half an hour, as water kept gently boiling will dissolve in an hour. All other circumstances being equal, the *length of time* during which the boiling continues will assuredly make a difference in the quantity of the poison taken up.

EXP. 6.

Arsenious acid, in fine powder, was boiled for several hours to saturation, in two separate quantities of water. These solutions were, after filtration, kept apart; and allowed to stand for *six months*, in well-stoppered bottles. A very abundant crop of octohedral crystals, lining the whole interior of the bottle, was deposited in each case. After this

lapse of time, twenty-five grains of the filtered solution (A) were evaporated to dryness; and the solid residue weighed .7 grains. Hence,

1000 gr. of the solution contained $40 \times .7 = 28$ gr. or $\frac{1}{35}$.

Twenty-five grains of (B) left, as a solid residue, .6 gr. Hence,

1000 gr. held dissolved $40 \times .6 = 24$ gr. or nearly $\frac{1}{41}$.

The mean of these two experiments will be as follows:

1000 gr. of a saturated solution, after six months standing, held dissolved, 26 gr. or $\frac{1}{38}$.

In closing these remarks on the solubility of arsenic in boiling water, I shall subjoin the results of some experiments on the recently-prepared, or transparent, arsenious acid: and I am the more desirous of doing this, since the statements of Guibourt, relative to the transparent being *less soluble* than the opaque variety, are not supported by them. In a medico-legal point of view, the question of a difference of solubility in these varieties of arsenious acid is not, perhaps, of much importance; since the pure transparent arsenic is with difficulty obtainable, and is rarely sold by druggists.

EXP. 7.

A perfectly *transparent* and recently-prepared mass of arsenious acid was finely pulverized; and a weighed quantity of the powder was gradually added to two fluid ounces of water, kept *violently* boiling for *an hour*, the waste by evaporation being made up. Forty-six grains were dissolved.

1000 gr. water dissolved 46 gr. or nearly $\frac{1}{21}$.

From this solution there were deposited in crystals, after 48 hours, 27.3 gr. and $46 - 27.3 = 18.7$.

1000 gr. water held dissolved, on perfect cooling 18.7 gr. or $\frac{1}{53}$.

EXP. 8.

In this experiment, four ounces of water were kept boiling for *an hour*, and pulverized *transparent* arsenic was gradually added. There were dissolved 95.1 gr. Hence,

1000 gr. water dissolved $(95.1 \div 2) 47.55$, or $\frac{1}{21}$.

From this solution there were deposited, in crystals, after 48 hours, 68.3 gr. Hence, $95.1 - 68.3 = 26.8 \div 2 = 13.4$ gr.

1000 grains of water, held dissolved, on perfect cooling, 13.4 grains, or $\frac{1}{74}$.

The results of these experiments show, that there is *certainly not always* the difference in the degree of solubility of these two varieties of arsenic, which M. Guibourt suspected; and which, upon his authority, is to be found stated in many chemical and medico-legal works. The quantity dissolved of either variety, under similar circumstances, according to these experiments, may be regarded, for all practical purposes, as the same.

In cases of criminal poisoning, it occasionally happens that *cold* or *temperate water* is used as the solvent for this poison, and a witness is expected to state the degree of its solvent powers. The consideration of this, led to the performance of the following additional experiments.

EXP. 9.

Eight fluid ounces of *temperate water* were poured upon twenty grains of the pulverized opaque arsenic, in a clean glass vessel. The powder immediately collected in lumps, which partly floated, and partly remained at the bottom of the vessel. A slight film of powder formed by repulsion on the surface of the water. The vessel was covered over, and allowed to stand 72 hours, having been first well agitated. The liquid was filtered, and the filter carefully dried. The residuary undissolved powder weighed 16 gr. And, $20 - 16 = 4$. Hence,

1000 gr. water ($\frac{1}{3}$ ij.), dissolved . . . 1 gr. or $\frac{1}{1000}$.

Twenty-five grains of the filtered solution, evaporated, left .03 gr.; which is nearly equal to the proportion above determined from the undissolved residue.

EXP. 10.

Another experiment was performed, which only differed from the preceding in the circumstance of the vessel having been *frequently agitated*. The undissolved powder left on the filter, after drying, weighed 11.5 gr., and $20 - 11.5 = 8.5$ gr. Hence,

1000 gr. water ($\frac{1}{3}$ ij.), dissolved . . . $(8.54) \div 2.125$ or $\frac{1}{170}$.

Twenty-five grains of the filtered solution were evaporated; and left not quite .06 gr., a proportion rather larger than that above deduced.

It follows, from these experiments, that very nearly the same quantity of arsenious acid is taken up by hot water allowed to cool, and cold water poured, on this substance in powder; provided the vessel, containing the cold water, be frequently agitated. They also shew the necessity for a continued application of heat, in order that the poison should be dissolved in any considerable quantity. It is a curious, and hitherto an unexplained fact, that water should retain so much more of this poison, as from ten to twenty times the quantity, when *perfectly cooled* from a boiling saturated solution, than it will take up at common temperatures without heat. It would seem to indicate, that heat must excite some permanently powerful affinity, between the particles of arsenious acid and water, which did not previously exist.

We see, then, that trivial circumstances may bring about material differences, in the results of experiments on the solubility of this poison;—a subject, which calls for the serious attention of medical jurists. Our legal authorities cannot stop to inquire into the causes of the differences among experimentalists. They expect that the witness, who is summoned before them to give professional evidence in a case of criminal poisoning, should be prepared to answer some such questions as the following:—

Is there any difference in the degree of solubility of the different varieties of arsenic?

To what degree is arsenic soluble in hot water?

To what degree does it become more soluble by long boiling?

What quantity is held dissolved, when a boiling solution has perfectly cooled?

To what degree is arsenic soluble in cold water?

The act of malice, on the part of a prisoner, is often to be inferred or disproved by the quantity of poison held in solution in a liquid: and an instance has occurred, within the last few years, in which a man was acquitted of the crime of a wilful attempt to poison, because the quantity dissolved was insufficient to cause serious consequences.

This, then, is a point to which a judicial inquiry may tend, in a case of "attempted poisoning"; which, it may be remarked, involves the same punishment by our law as the actual perpetration of murder by poisoning. The question put to a medical jurist may be:—Is the quantity of a solution of arsenic, which a party may have administered, sufficient to cause serious symptoms, or to bring about a fatal result?

In the case of Nairne and Ogilvie*, who were tried at Edinburgh, in 1765, for murder by poisoning, the medical witness, Dr. Scott, who appeared in the defence, was particularly questioned, by the prisoner's counsel, respecting the solubility of arsenic. He is stated to have said, "that he has made sundry experiments on arsenic—that he knows it *will not dissolve in warm water*—and that the common arsenic, that is to be met with in the shops, although pretty finely powdered, *falls to the bottom* of a vessel with water, almost *instantaneously*." Dr. Smith, in commenting upon this evidence, observes: "We are too much addicted, even now, to talk of arsenic, as if it were soluble with the same readiness as sugar†." But even admitting the existence of exaggerated views on the solubility of the poison, this cannot excuse the very incorrect statement in the above evidence; namely, that arsenic is insoluble in warm water. Dr. Scott also affirmed, what experiment will shew to be a popular error, namely, that the pulverized poison almost *instantaneously* sinks to the bottom of a vessel of water: (*vide* Exp. 1 and 9). This error, it is of more importance to notice than may at first sight appear, as I shall presently endeavour to shew. Arsenious acid, it is true, is more than three and a half times heavier than water, but, like magnesia, and other finely-powdered substances which are of greater specific gravity than that liquid, a portion of it will float from repulsion; and, indeed, it is somewhat difficult to cause the powder entirely to sink. This fact was long ago observed by Dr. Addington, who gave evidence, in 1752, on the trial of Miss Blandy for

* State Trials.

† Analysis of Medical Evidence: Appendix.

poisoning her father with arsenic*. In his evidence respecting the nature of the powder (arsenic) which he had been required to examine, he states: "Part of it swims on the surface of cold water, like a pale sulphureous film; but the greater part sinks to the bottom, and remains there undissolved." The floating or sinking of this poison becomes a question of importance, when a quantity of it has been mixed with a large quantity of water, and the upper stratum only of the fluid has been swallowed. In the case of Bodle, who was lately tried for the murder of his grandfather by poisoning him with arsenic, the defence was partly made to rest upon a point of this nature†. It was alleged against the prisoner, that he had put arsenic in powder into a large kettle of water, which had been placed to boil on the fire, for the purpose of making coffee for the deceased's breakfast. The prisoner, in his defence, which, I understand, was written for him by an accomplished barrister—and which indeed bears about it marks of the greatest ability and ingenuity—was made to say: "I am informed, that to have put arsenic into the kettle, would have been a very doubtful mode of administering it; and that its weight would have caused the greater portion of it to sink to the bottom of the water. It was stated, indeed, before the coroner, that it was only upon the presumption that the boiling of the water would cause the arsenic to rise from the bottom, that the possibility of arsenic being poured from the kettle was admitted. But although, in making tea, the water is used in a boiling state, it is not necessarily so in preparing coffee. The coffee has again to be boiled; and therefore it is of no importance that boiling water should be poured on it. In point of fact, boiling water is seldom so used." In relation to this part of the prisoner's defence, however, I may observe, that so far from a doubtful, it would have been a very *certain* mode of administering the poison. A portion of arsenic, notwithstanding its supposed weight—certainly sufficient when poured off to destroy life—might have floated, whether the water were hot or cold. The possibility of the poison having been poured from the kettle, being made to rest

* State Trials.

† Home Circuit, Maidstone, December 1833.

upon the presumption that the boiling of the water would alone cause the arsenic to rise from the bottom, furnishes an appropriate illustration of the danger of attempting to prove too much. If the water had boiled, so as to have produced this effect, then it becomes probable that sufficient poison would have been dissolved, to give rise to fatal consequences. But in the defence, it is attempted to be shewn, that the water did not boil, from the fact of boiling water not being commonly required for the making of coffee. Here, then, the inference would be, not that all the poison would have sunk by its weight, but that sufficient would have floated, and have remained on the upper stratum of water, to allow of a fatal dose being poured off. There was no evidence to shew that the poison, in this case, was administered through the medium of water in the kettle; but it appears to me that the reasons assigned in the defence, for its not having been so administered, are, medically speaking, wholly unfounded.

It very commonly happens, that those who take, or criminally administer, arsenic, mix the substance loosely with water, and swallow it in this state. This was the manner in which it was taken in the two fatal cases reported. In some instances, however, murderers display great diabolical ingenuity. A case was tried at Mayence, in March 1835, in which the evidence clearly proved, that the prisoners had poisoned the deceased and several persons previously, by administering arsenic in a saturated solution in water. One of them confessed that she had boiled the poison in water, allowed it to cool, filtered the solution, and then administered it, by small quantities at a time, in wine, milk, gruel and other liquids. On one of these occasions, the poison operated with fatal rapidity—a circumstance which led to the detection of the crime. As might have been anticipated, not a trace of arsenic could be discovered, on analyzing the contents of the viscera of those who had perished in this manner.

The solubility of arsenious acid, in liquids containing organic matter, sometimes forms a subject of inquiry in our courts of law. A suicide generally selects *water*, as the menstruum for dissolving the poison;—a murderer, in most

cases, selects some liquid article of food, probably for the purpose of more effectually lulling suspicion, by concealing the *supposed* taste of the poison*. Tea, coffee, brandy, or gruel, is thus very often made a vehicle for the administration of arsenic. No certain opinion can be expressed respecting the solvent powers of gruel, broth, or liquids of a similarly viscid nature. These last-named menstrua *mechanically suspend* the particles of arsenic, exactly in proportion to their viscosity; and thus a very powerful dose of poison may be administered in a small quantity of liquid. But few experiments have been performed on the solubility of arsenic in organic liquids. Hahnemann found that water impregnated with mucus or milk dissolved the poison with difficulty. Dr. Christison states generally, that the solubility of arsenic is much impaired by the presence of organic matter. According to this gentleman, a cup of tea left beside the fire, at a temperature of 200°, for half an hour, upon two grains of arsenic, did not entirely dissolve even that small quantity†. This, however, gives us but a very imperfect notion of the solvent power of the liquid, since the quantity of tea which the cup contained, is not stated. In consequence of finding no satisfactory statements on this subject, the following experiments were performed.

Exp. 11.

Eight fluid ounces of *tea, with milk and sugar*, at a temperature of about 170°, were poured on twenty grains of opaque arsenious acid in fine powder. The mixture became instantly turbid, and the greater part of the poison sank to the bottom of the vessel. The tea was well agitated, and allowed to remain, with the vessel covered, seventy-two hours. It was then filtered—a process which occupied a

* It is generally imagined that arsenic has an acrid, caustic taste: it is so stated in numerous chemical and medico-legal works; but it is pretty certain, that arsenic, which possesses such a taste, cannot be pure. I have not been able to perceive any other than a faintly sweetish taste, as described by Christison; and the annals of criminal poisoning plainly shew that, in nine cases out of ten, the poison has been swallowed without producing any peculiar sensation on the tongue.

† On Poisons, p. 177.

whole day. The filter was well dried; and the undissolved powder left on it, separated and weighed. Allowing for the admixture of a small quantity of foreign matter, the undissolved arsenic weighed, as nearly as could be estimated, 15.5 gr. Hence $20 - 15.5 = 4.5$ gr. dissolved by eight ounces of tea, and $(4.5 \div 8 = .5625)$ rather more than $\frac{1}{2}$ gr. to each ounce of the liquid.

For very obvious reasons, no comparison of solubility, from the *weight* of the solvent, can here be instituted. We can only judge by employing a measured quantity of the solvent: and it is this standard, indeed, which it is alone requisite to follow, for practical purposes.

Exp. 12.

Eight ounces of *coffee*, with *milk and sugar*, at a temperature of 160° , were poured on twenty grains of arsenic. The mixture was well agitated, and allowed to remain covered seventy-two hours. It was then filtered, but the liquid was more than four days in passing through; and the large quantity of organic matter, left on the filter, completely obscured the undissolved arsenic. The coffee in this case, when filtered, was so weakly impregnated with arsenic, that half an ounce of it, acidulated with acetic acid, and treated with sulphuretted hydrogen gas for half an hour, gave no arsenical re-action whatever. The hydrogen test indicated the presence of arsenic in very minute proportion.

Exp. 13.

Eight ounces of *coffee*, boiled and clarified, but without milk and sugar, were poured, at a temperature of 170° , on twenty grains of the poison. The mixture was frequently agitated, allowed to stand seventy-two hours, and then filtered. The filter was dried; the residuary powder found on it—which was but little impregnated with organic matter—was then placed in a balance, and found to weigh, making full allowance for combined impurity, 11 gr. Hence $20 - 11 = 9$ gr. dissolved by eight ounces of coffee; or $(9 \div 8 = 1.125$ gr.) rather more than a grain to each ounce of the solvent.

Exp. 14.

Two ounces of common *brandy* were poured on twenty grains of arsenious acid. Not a particle of the powder floated, but the whole remained at the bottom of the vessel. The mixture was frequently agitated during seventy-two hours. It was then filtered, and the filter slowly dried. The undissolved residuary powder, allowing for a slight impregnation with organic matter, weighed 17.3 gr. Hence $20 - 17.3 = 2.7$ gr. dissolved by two ounces of brandy; or $(2.7 \div 2 = 1.35)$ about one grain and three-tenths to the ounce*.

Exp. 15.

Eight ounces of cold *porter* were poured on twenty grains of arsenious acid. The mixture was allowed to remain for the same period as in the preceding experiments, with frequent agitation: it was then filtered. The undissolved residuary powder weighed 16 gr. Hence $20 - 16 = 4$ gr. dissolved by eight ounces of porter; or $(4 \div 8 = .5)$ one half grain to each ounce of solvent.

The above experiments were repeated several times, without any material difference in the results.

From the whole of these experiments, I may perhaps be permitted to draw the following conclusions:—

1. That hot water, allowed to cool from 212° on this poison, dissolves less than $\frac{1}{100}$ of its weight, or about $1\frac{1}{4}$ grains to each ounce of water.
2. That water, boiled for an hour on this substance, dissolves $\frac{1}{24}$ of its weight, or rather more than 20 grains to each ounce.
3. That this water (2), on perfect cooling, does not retain more than about $\frac{1}{10}$ of its weight, or 12 grains to the ounce.
4. That water boiled on arsenious acid to the most perfect

* According to Mr. Brande (*loc. cit.*), 1000 parts of alcohol at 60° dissolve 12.5 gr. arsenious acid, or about $\frac{1}{80}$. I have found that two fluid ounces of cold alcohol, digested for ten days on 20 grs. of arsenious acid, dissolved 4.5 grs. The organic matter contained in brandy, may interfere with the solvent powers of the alcohol.

state of saturation, after having stood six months, holds dissolved about $\frac{1}{38}$ of its weight, or 13 grains to the ounce.

5. That there is no observable difference in the solubility of the *transparent* and *opaque* varieties of arsenious acid.

6. That water at ordinary temperatures will dissolve from about $\frac{1}{1000}$ to $\frac{1}{500}$ of its weight, or from $\frac{1}{2}$ grain to 1 grain to each ounce of solvent, according to circumstances.

7. That the presence of *organic matter* in a liquid is an obstacle to the solution of this poison. Thus hot tea, and cold porter, will not take up more than about $\frac{1}{2}$ grain to the ounce; while hot coffee and cold brandy, do not dissolve more than a grain to the ounce.

There are two points of practical importance, which these experiments suggest in relation to the analysis of organic liquids suspected to contain arsenic, especially when the liquids have been obtained from the stomach or intestines : 1st, To dilute the liquid considerably with water ; and, 2dly, to boil the liquid thus diluted for at least two or three hours. By attending to the first point, we in a great degree destroy the effect of organic matter in impairing the solubility of the poison ; and by the second, we insure the solution of every portion of poison which may be present.

AN ESSAY
ON THE
SAFETY-VALVE FUNCTION IN THE RIGHT VENTRICLE
OF THE
HUMAN HEART;
AND ON
THE GRADATIONS OF THIS FUNCTION
IN
THE CIRCULATION OF WARM-BLOODED ANIMALS.
BY MR. T. W. KING.

THE theory about to be brought forward has been already advocated, in separate parts, in two distinct Papers presented to the Royal Society since the spring of the year 1835, and in a recent communication to the Huntrean Society.

The following is an abbreviated account of the opinions formerly advanced, but hitherto unpublished;—and additional facts are likewise adduced. The whole is arranged with especial reference to the Preparations contained in the Museum of the Hospital*.

PART I.—OF THE SAFETY-VALVE IN MAN.

SECT. I.—OF THE CAUSES OF DISTENTION IN THE RIGHT VENTRICLE.

The explanation of a safety-valve, as it is presumed to exist, is this: The veins, being more or less influenced by their own number and capacity, by the position of the body, by cold, compression, repletion, and respiration, the blood is brought to or collected in the right ventricle in varying

* Since the early part of the year 1835, an extensive and novel series of Preparations, considerably more than three hundred in number, have been placed in the Museum, in illustration of the theory which is explained in the title above: and the Collection has also been enriched by a valuable little set of models, displaying the adaptations of all the parts in the heart of man. These last form but a very inconsiderable portion of the labours of Mr. Joseph Town; an artist whose ability is only surpassed by his activity; and whose works, already exceedingly numerous, and perhaps of unequalled execution, are incessantly adding to the rarity of the Collection.

quantities; and on the occasions of the most copious influx, the cavity becomes distended; upon which, portions of the tricuspid valve are drawn aside, an aperture of reflux is produced, and the force of the ventricle is diverted from the pulmonary circulation at the moment when the lungs might otherwise be overwhelmed.

The exposition of the varied and gradational structures in the right ventricle of the hearts of animals will be subsequently produced, both as corroborative and in illustration of the fact of a refluent function. In man—who, in a scale of animals arranged according to their share of this function, is not far from holding a middle place—the distention of the right ventricle depends chiefly upon the forces which bring the blood into it; and, accordingly, the nature of these forces will first require consideration.

Of the Force of the Venous Current.—The activity of the venous circulation is shewn by the rapid flow of blood in a vein that has been momentarily emptied by compression (as on the back of the hand); and again, by the distensive fulness so readily produced on obstructing the current (as by a ligature on the arm); which effect takes place notwithstanding the elastic resilience of the tubes and the cutaneous pressure—powers which are sufficient instantly to dissipate the congestion when the obstruction is removed, though not always sufficient of themselves to overcome the gravitation of a considerable column of fluid contents.

With respect to the motion of the blood in the great systemic veins, Magendie says, “It is very probable that the blood flows with unequal rapidity in each of them; but what is certain, is, that the three volumes of fluid endeavour to enter the right auricle, and that the efforts thus made are very considerable.”

In order to estimate the force of the venous stream, we may consider the jet produced from a punctured vein, whose course has been arrested, as by a ligature, in venesection; and at the same time we may observe the increase of the jet when the muscles are set in motion, as an indication of the general influence of muscular exertion.

Of the Causes of the Venous Current.—In studying the several powers which combine to propel the blood through

to observe it, I cannot suppose the statement liable to objection.

I proceed to further evidence.

It is not long since it occurred to me, that an instrument of sufficient delicacy might detect similar venous pulsations elsewhere. A fine capillary lever, with a long index radius, seemed at once to afford all that was necessary. I drew out such a thread in black sealing-wax, about two inches long; and, with a little tallow, fixed this across a vein on the back of my hand, so that nine-tenths of its length might project on one side of the vein, the power of which was thus applied very near to the fixed extremity.

In this manner, with the precaution of keeping the vein moderately distended, the movement became very manifest, especially under circumstances of repletion: the little index point slowly rose, and fell with, or possibly a little later, than each radial pulsation. I have reason to think, however, that, in my own person, a very few hours' fasting destroys this phenomenon, as far as it is appreciable by the means described.

The action of this little sphygmometer has been witnessed by many; and I scarcely think that any exception can be fairly made to its application, to prove the existence of a pulse or undulating current in the veins. Applied to an artery, it plays freely and quickly: on a vein, its movement is very steady, and only visible when neatly adapted; whilst if applied to any other part, no motion is produced. In all parts of the arm I have found it indicate a distinct pulse. In some veins, which, by a semi-rotation of the hand may be placed either in front or posteriorly, the effect has been the same in both cases*. On the hand, it is not easy to feel confident that the venous and arterial pulses are not synchronous; but with the sphygmometer applied to a small superficial vein over the head of the radius, a slow rise was seen very manifestly later than the quick radial pulse of the same arm: indeed, it was not quite certain to the mind,

* This examination of the pulse of the same vein in different positions was intended to meet the suspicion, that an adjacent artery might be the cause of the motion.

whether each venous dilatation belonged rather to the preceding than the succeeding radial beat, when the pulses were full and scarcely 60 in the minute.

By the same means, the veins of the leg and foot have also been seen to pulsate, though less forcibly. My friend Dr. Foville, who recently visited London, witnessed the repetition of some of these experiments; and was desirous to have the jugular vein examined in this manner, though we were both alive to the difficulties which the site of this vessel might present.

The Doctor was upon very moderate diet, on account of indisposition; and his circulation being very tranquil, in the evening, he very calmly laid himself across a table, and, after about a minute's repose, when no perceptible motion affected the vein, the sphygmometer was applied rather above the middle of the neck, the vein being full and of a large size. The motion that it received was the same steady rise which we thought characteristic of the venous pulse, without quickness, and without tremor.

There may be some who will continue to hold, that the collateral arterial impulse is a more probable source of this pulsation than the continuity of a capillary wave. To such, I would again point out the difference of the pulses, as to time, force, and duration; and also remind them, that the influence is communicated to the instrument when it is accurately affixed upon a vein, but not when it is applied to any other part.

With respect, however, to the influence of the larger arteries upon adjoining veins, I cannot doubt that it is considerable. And when the arterial impulse operates collaterally upon such vessels as the *venæ comites*, which are so numerous and closely bound about the arteries and copiously supplied with valves, I suppose that there is not a more efficient force of circulation in the veins, particularly in the legs when they are erect and motionless*. I may also

* When gravitation tends to distend these veins, the compressions afforded by muscles and skin in repeated movements being absent, the valves would be left unemployed, were it not that the well-applied impulse of the beating artery tends always to empty the valvular interspaces, and produce a current towards the right auricle. It must be admitted, that the capillary
vis

observe, that whether the veins pulsate by capillary afflux or from adjacent compressions, there is still, by the action of the valves, the same kind and degree of accelerated venous current.

When the number and capacity of the veins are considered in relation to the contents of the arterial trunks, we cannot wonder that the communicated effect is slight: and in weighing this, we must remember, that the sphygmometer not only magnifies the extent of the motion, but also, in a certain degree, its rapidity; so that the venous pulse, when visible to the eye, should be a very deliberate diastole.

To the preceding statements I have to add the following facts, which have been observed more recently. In the pursuit of the same study, I was attending Dr. Bright in his visit to the wards of the Hospital, and found two men with visibly pulsating veins on the backs of their hands. They were both five-and-thirty years of age. The first presented the most striking evidence. The Doctor not only saw, but thought he could feel, the venous diastole; the wrist being all the while embraced with some firmness, to render the veins large. The patient had an hypertrophic heart, and a very powerful pulse: his veins were rather few.

In the second instance, which was less marked, the man had had renal anasarca for sixteen days. His heart probably was not quite sound. The pulse was soft, and tolerably good. He was perspiring profusely. The dorsal veins of the hand were pretty numerous and large; and they were covered with abundance of hair; which was remarkable, for the reason that the veins not only beat visibly in many places, but that particular hairs, which were well adapted for the purpose, seemed to form so many natural sphygmometers. It was here also necessary to enlarge the veins by gently grasping the wrist.

We may readily perceive a variety of circumstances that must necessarily affect the venous pulse, and the degree of its manifestation. Such are the application of cold or heat,

vis à tergo cannot well be separated from the consideration of a collateral impulse, when we endeavour to estimate the forces of the cerebral circulation, which is unaided by valves: and other parts afford a similar difficulty; as, for instance, the vascular tissue of a solid viscus or cylindrical bone.

and of frictions, and the continued exercise or rest of the part for a given time;—and again, the state of repletion, the nature of the food, the capacity of the veins, with the health, the age, and the sex of the individual.

I may venture to express an anticipation, that more careful observation, even with the unassisted eye, will detect pulsating veins more frequently than has hitherto been done, and even render this fact available in diagnosis. I would also hope that the examination of the veins, by the help of the sphygmometer, may become still more generally serviceable in practical matters.

I come now to the examination of those rare cases of disease in which the venous pulse is admitted to exist by all physicians, although it has been seen but by a very few.

The only unquestionable instance, within my own experience, occurred in a patient, of whose history, before and after death, I preserved pretty detailed accounts. Of these, the following is an abstract:—

A little girl of eleven years of age, who had suffered both privations and ill treatment, became the subject of purpura in diffused patches, attended with hæmorrhages, and a febrile state; during which, on very gently grasping the wrist in feeling the pulse, I observed for several days the numerous and rather full veins of the hand both prominent and beating. There was, in all of them, a very distinct diastole and systole; synchronous, as they seemed, with those of the radial pulse. This patient appeared to be in a convalescent state; when she was rather suddenly found to grow worse, as if from internal hæmorrhage, and was carried off in a few days.

In addition to the external bleedings, the post-mortem examination offered the appearance of petechiæ beneath many of the serous membranes. The parotid gland was in a state of suppuration; the lungs were œdematous; and the heart's substance healthy. The blood was watery, and the kidneys were affected with a pale hypertrophy.

The earliest notice I have been able to find of a similar case, is that which Haller* has quoted: and single instances

* *Elementa Physiologiæ*, T. II. p. 256.

have been more recently related by Steinbuch*, in the Philadelphia Journal†, by Sundelin‡, by Beyer§, by Dr. Davis of Dublin||, by Dr. Elliston¶, by Dr. Ward**, by Dr. Graves††, (who indeed records two), and, lastly, by Dr. Benson‡‡.

These cases do not appear to me to admit of any tenable objections. The unnatural pulsation was well marked, and well observed; but it is impossible to give a satisfactory account of the events, in this place. One was in a young convalescent fever patient; others occurred during fever, and mostly with petechiæ; and others, again, in more chronic cases, and generally with some thoracic obstruction. In all, there was some degree of vascular excitement.

In reviewing these cases, I find no other conclusion admissible, than that the pulse is derived from or through the capillaries. The details and circumstances present some very remarkable features. For the present, however, the facts are only produced to elucidate the sources of accumulation in the right ventricle.

There are yet some secondary but powerful causes of congestion in the right ventricle, which must be briefly described.

The Influence of Atmospheric Pressure.—Another source of impulse in the venous current is doubtless seen in the pressure of the atmosphere, at least in those great vessels which open into the chest, and which are emptied more or less by the inspiratory efforts. This action is likewise indirectly aided by the proper valves of the vessels, but not without an especial regard to facilitating the circulation of

* Journal der practischen Heilkunde, Sept. 1815. See also the Journ. Compl.

† See the Lond. Med. Journ. V. III. p. 361.

‡ Sundelin in Archiv für Medicinische Erfahrung, 1822. See also the Journ. Compl.

§ A Paper by Beyer of Ohlan, on this subject, in the Journal Complimentaire, T. XXI. 1825.

|| Dublin Hospital Reports, V. 4.

¶ See the last Edition of Blumenbach's Physiology.

** In the London Med. Gaz. V. 10.

†† In the Dublin Journal of Med. and Chemical Science for Sept. 1834

‡‡ Ibid. Nov. 1835.

the superior cava, before that of the inferior half of the body; a circumstance which is deserving of some attention.

The Effects of Compression by Muscular Action, &c.—It is very remarkable with how great force the contents of the veins may be driven inwards to the heart by the rapid movements of the body; the varying pressure of muscles and integuments acting on the venous tubes, with the assistance of their valves, to hurry on the current of the blood. One sustained effort of the body may obstruct and distend many particular veins; but the quickly-repeated pressure of muscles and skin, &c., as in the free motions of the limbs, operating upon all the veins of a part in succession, must necessarily propel all their blood towards the heart very speedily. Let any one with well-developed veins take an opportunity, in a state of repletion, when the superficial veins are become turgid, to make a few general and hasty movements of the body, and all turgescence will disappear at once. On standing, after dinner, the veins of the leg swell freely; but a few steps, performed with complete flexions and extensions of the joints, instantly empty every vessel. The internal congestions which follow these exertions are felt to be in the chest, and have been experienced by every one.

The Effect of Repletion.—It would be out of place here to dilate upon the circumstances of general venous repletions. The rapidity with which fluids and chyle are occasionally poured into the veins in large quantities is well established. In experiments, fluids have been absorbed in great abundance from the stomach; and, at the same time, the circulating system, including the spleen, has become distended. It is well known how inordinately some persons drink, and how quickly the fulness of the vessels follows: indeed, the accelerated secretions are the best proofs of the progress of absorption. That many quarts are often thus absorbed in a few hours is as certain as that the fluids are not evacuated by the bowels. The turgid surface and dilated veins, manifest after a full meal, will sufficiently testify the copious influx of chyle and fluids into the circulation; not to mention the state of the heart and lungs, or that of the arteries and discerning organs.

The Effect of Cold.—Considerable degrees of cold applied over the surface of the body must have a material effect upon the venous system, internally. The surface is blanched by the contraction of its capillary blood-vessels, and the anserine roughness is probably dependent upon a similar cause. At the same time, a general and rather firm contraction of the exposed integument propels the contents of the larger superficial veins towards the right side of the heart, whilst the arteries and left ventricle soon evince the effect of an impeded capillary circulation.

Disturbed Respiration.—On suspending the respiration by a voluntary effort, the movements of the left ventricle and arterial pulse continue unaltered, even as long as we are capable of maintaining the effort; and the experiment may be prolonged considerably, by taking the precaution of performing several full* respirations immediately before it. From this I conclude, that the circulation through the lungs is sustained until the aërating functions of those organs is nearly or quite suspended—until the oxygen they contain is expended; but there can be no doubt, to the pathologist and the experimentalist, that every considerable impediment to respiration produces delay in the right side of the heart and its vessels. The like result will probably happen, during severe exertion, from particular or general interruptions to the progress of circulation.

In the more transitory obstructions of the lungs by disease, the impediment in the circulation must be pretty obvious.

The Combination of Causes distending the Right Ventricle.—We have already adverted to the influence of cold, repletion, and the muscular compression of the venous system, as individual causes of internal congestion; but whatever power may be imputed to any one of these, the reflecting physiologist will scarcely hesitate to admit the inevitable existence

* The augmented power of suspending the respiration, after a repetition of complete expirations, appears to have been tried by Professor Faraday, according to Dr. Williams. See Dublin Journ. of Med. and Chem. Science, Sept. 1835, p. 153.

of distention* in the great veins and right side of the heart, in the case—which is by no means a supposititious one—where, in a healthy person, accident combines the three great causes of internal accumulation; namely, sudden repletion, exertion, and exposure to cold. And may not the result of an impeded respiration be superadded to this combination†?

SECT. 2.—CIRCUMSTANCES ILLUSTRATING ACCUMULATION IN THE RIGHT VENTRICLE.

The Living Heart exposed.—That the right ventricle readily becomes turgid from obstructions to the pulmonary circulation is well seen in experiments upon the living heart, *in situ*. The right side begins to swell with the first disturbance of the respiration, whether the lungs are kept distended by tying the trachea, or suffered to collapse in opening the chest, or even if an imperfect artificial respiration be kept up; whilst the reduced state of the left side of the heart clearly shews that the lungs transmit but little blood.

* We may see the veins of the temple or forehead dilate, independently of exertion or disease, even more than often happens in the depending hand; so that the actual internal pressure, and the compressing power exerted by the skin and coats of the vessels, must be very considerable: and may we not safely conclude, that this fulness extends through the larger veins which lead to the right ventricle; thus forming a fluid column from twelve to twenty inches high, the gravity and impulse of which are directed upon a cavity, the extent of whose surface may probably vary, in health, between eight and fourteen square inches, and, in disease, from twelve to eighteen? The influence of gravitation is of course augmented in the inverted positions of the body. It is, however, impossible to estimate the physiological effect of the accumulated forces of the venous streams, when gravitation, and the natural current, or *vis à tergo*, may all chance to unite with disturbed respiration, repletion, cold, and exertion, in various or excessive degrees, to overflow the right side of the heart. Lastly, the increased feebleness of a distended ventricle, in a state perhaps of fatigue, and the additional resistance afforded by the increased quantity of contents, must still further augment the difficulty. Would it not also appear that any pulmonary turgescence or obstruction must impede the systole?

† We shall hereafter have to trace the analogies of the above conditions in animals—in the arrested respiration of the divers, and in the inactivity of many animals under circumstances of repletion, which are variable in some, and in others seem almost habitual. The very different proportions of drink necessary to various kinds of quadrupeds and birds present a similar analogy.

Accumulation in Dying.—Having been for many years in the constant, almost daily practice of examining the dead, I have been led to observe, that a very great number of deaths from disease are attended with some degree of unnatural fulness of the right side of the heart, whilst the left side is commonly found empty. Suddenly-fatal diseases, characterized by great depletion, may terminate with partial emptiness, and contraction even, of the right side of the heart; though never perhaps complete. The left side is continually found, in death, to contain only a few drachms of blood, with the exception of those cases involving derangements of the part itself.

I feel also confident in declaring, that in the sudden death of the generally healthy frame the blood is expelled from the left cavities, but commonly fills the right even in cases of hæmorrhages*. In the last, however, the strength of the right ventricle seems sometimes to resist the diminished tendency to distention, and it becomes firmly contracted. In many cases of death from disease, the distention of the right ventricle is found to be most excessive; and this congestion is most frequently seen, when it would be impossible to impute any part of the effect to the influence of *pulmonary resilience*†, or any mode of atmospheric agency. The little power of forming a vacuum within the chest, which might belong to the healthy lung, is evidently overwhelmed by many common diseases; which are, indeed, frequently the cause of congestion in the right ventricle, to the highest degree: as when the lungs remain distended to the utmost from bronchial obstruction and emphysema, or from the effusions of inflammation, or from turgescence and extravasations of blood; as when, also, the lungs are obstructed by different pleural effusions, or any morbid diminution of the thoracic cavity.

* I have seen the same distention in animals dying from hæmorrhage, or with much loss of blood.

† This resilience no doubt plays a certain part naturally; and the movements of inspiration, in conjunction with the force of gravitation, and the action of the venous valves, may be very important to the free circulation of the blood.

External Pressure acting on the Heart.—There are numerous cases of disease in which the surface of the heart is in a state of compression from the fulness of the chest; but, notwithstanding, the right auricle and ventricle are found full, evidently in consequence of accumulation from the veins; whilst the lungs and pulmonary artery have been suffering from obstruction; which has been, in fact, the fatal disease.

Hypertrophy of the Right Ventricle.—Even the common morbid increase of muscularity in the right ventricle indicates a delay within*; for we know nothing of the simple enlargement of a muscle without some additional excitement in the way of difficulty or exercise; and this hypertrophic affection is constantly found in connection with obstructions of the pulmonary circulation, and pretty constantly with some permanent distention of the thickened cavity, as well as frequently with a dilated pulmonary artery.

Distention.—The fulness of the right ventricle in death, in spite of its tonic contraction, seems very remarkable; and the more so, if we consider that the cavity contracts with great rigidity, when relieved from the internal distending force, within a moderate time after apparent death.

Dilatation.—The fact, that the morbid dilatation of the right ventricle is not unfrequent, may serve to prove that the cavity is subject to a certain internal expanding force, at least, in a state of disease—a force that cannot be supposed slight, when it is observed to operate effectually against the natural contractile power, and often against a very considerable increase of substance and power in the muscular sac. The dilated and hypertrophic right ventricle is continually found in death fully distended with blood; and I am inclined to think that this dilated ventricle is diminished in some degree after death, by the tonic contraction common to all muscles. It seems reasonable to infer, that in the natural states of the circulation, some degree of distention is of much more common occurrence.

The Pulmonary Circulation powerful.—The strength of the right ventricle, and of the pulmonary artery and veins, indicates a circulation of considerable force; and although the

* External impediments to the systole, as from adhesions, are less common.

tricuspid valve may be slightly imperfect, yet the most complete adjustment which is natural to it as a valve, and the fullest propulsion of blood which the ventricle is capable of in health, must give rise to a pretty forcible circulation.

We find notwithstanding, at least in disease, that delay and internal accumulation may dilate the right ventricle, and thus the valve may become more imperfect: and I have found, on the other hand, in some cases of impeded circulation, that the right ventricle has so increased its power and thickness, as to resist all the unusual disposition to dilatation, overpowering the tendency to salutary regurgitation, and greatly troubling the pulmonary circulation. There may be in disease a too powerful valve, as well as a too free safety-valve; and the discrimination of these is, I believe, indispensable in pathology and diagnosis.

The morbidly increased power of the right ventricle may fairly be supposed to assist in the unnatural dilatation of the left side of the heart.

SECT. 3.—OF THE ADAPTATIONS OF THE RIGHT VENTRICLE.

Having considered the external circumstances which affect the fulness of the right ventricle, I come now to speak more particularly of the cavity itself.

The Consequences of Dilatation, as seen in Disease.—The first circumstances which led me to the study of the present subject, was the result of the post-mortem examination of a human right ventricle in a state of morbid dilatation. The part is still preserved; and affords conclusive evidence, that the right ventricle is liable to dilatation, and that the dilatation deranges its valves.

The last proposition is thus explained. The cavity is formed by the solid septum of the heart for its inner wall; and by a thinner, more extensive, and yielding layer of muscle for its outer or right wall; whilst each of these walls affords points of attachment to the cords of the valves. The distention of the cavity, operating chiefly upon the weaker paries, carries it outwards, together with the cords and curtains attached to it: and the parts of the valve being drawn from the proper plane of their valvular adjustment, the backward communication into the auricle remains open. (See Diagrams 1 and 2. Pl. 1.)

I am in the possession of many distinct records, written by myself and others, of similarly dilated hearts, which indeed are common enough; and it is certain that, under ordinary circumstances, the derangement of the valve is a necessary consequence of this dilatation: for, in the progress of post-mortem examinations, I have found, in hearts thus dilated, or only greatly distended by the final congestion, that, upon injecting the ventricle by the pulmonary artery, the tricuspid curtains, when stretched out, were, under all circumstances, a great deal too small to close the opening.

Derivative Power of the Right Ventricle.—Some authors have been perhaps too ready to suppose an inherent derivative power as accessory to the circulation of the right side of the heart; and it is necessary that we should inquire how far such an idea is objectionable.

In the first place, it is very difficult to imagine a simply muscular sac, of whatever figure, possessing in any considerable degree the power of expanding as well as of contracting: and to suppose, further, that the power of exhaustion may operate through flaccid venous tubes, seems still more unreasonable.

Again, the formation of the right ventricle appears incompatible with such a function.

With reference to the thickness of the *yielding* wall of the right ventricle in man—

| | |
|--|---------|
| Lobstein estimates it at two lines and a quarter | 2½ |
| Cruevilhier under four. | say, 3½ |
| Bouillaud, the chief authority of the day, at two and a half, . . . | 2½ |
| The measurement of Cuvier may be stated at two lines and one-third | 2½ |

He regards the thickness of the right ventricle, in man and most animals, as about equal to one-third that of the left. The mean thickness of the left ventricle in the human adult is very generally received to be seven lines.

The *capacity* of the cavities of the heart, as appreciable after death, is very uncertain. The right ventricle in many animals, when unaffected by any accumulation from the veins, slowly contracts in dying, until it will scarcely contain a few drops: under other circumstances, we are certain

that its extent and fulness may be very great; they depend on the degree or force of the venous afflux. The left ventricle, in death, always retains a small cavity, unless affected by disease.

After a single careful examination with the fingers and scalpel, I think it will be impossible for any one to attribute the slightest power of suction (atmospheric exhaustion) to the healthy right ventricle; since more than half of its parietes, consisting of a fleshy sheet very little more than two lines in thickness, are expanded over a surface comparatively unyielding, and always more or less convex*. Indeed, supposing a power of exhaustion to belong to the left ventricle, it is plain that the right cavity must be encroached upon, to admit of its dilating operation; for the right ventricle is folded over the left, and in a manner incloses it†. It is very true, that a heart may be seen to contract and dilate when placed in water; and a similar movement may be observed in the fibrous bands of a voluntary muscle; that is, a distinct contraction succeeded by a partial elongation, and this repeatedly, as I have often witnessed in limbs removed by amputation. The butcher makes a transverse division of the central fibres of the panniculus carnosus, and immediately a wide elliptical separation of the divided edges takes place; and this persists, yet the fibres are still seen contracting and elongating successively, after having permanently lost much of their normal length. In every case, a muscle, having acted fully, must require some extraneous force to re-adjust it for the repetition of the same complete action.

It can scarcely appear possible even for the left ventricle to be capable of spontaneously expanding with its full natural diastole; during which diastole it is palpably soft and loose: else what could be the use of the muscular auricle, and its contractions? and what would be the use of a densely organized set of veins, the impetus of whose current we know to be fully competent to the dilatation of both auricle

* See Diagram 3. Pl. 1.

† In some birds, the right ventricle is wound fully half round that of the left side.

and ventricle to an excessive degree, even when their walls have attained to nearly double their natural thickness*? Remembering the soft and relaxed state of the ventricle during its diastole, no one can suppose the cavity to be endowed with a power of dilating, even beyond the natural limit of its diastole. Yet the cavity does become morbidly expanded; sometimes, when its walls are unusually feeble; at another time, without any evident alteration in their substance; and, in a third case, the walls seem to increase, both in substance and power, during the process of dilatation†.

May it not be concluded, that the natural full diastole of the right ventricle (as well as that of the left) takes place by a forcible internal accumulation; which accumulation, it is plain, can be the only cause of all greater degrees of dilatation?

SECT. 4.—DESCRIPTION OF THE HUMAN TRICUSPID VALVE.

The right auriculo-ventricular opening is oval‡; and to its circumference the membrane of the tricuspid valve has attachment, without any distinct interruption; whilst its floating border, depending into the ventricle, is deeply fissured, so as to form three or more scalloped or angular *curtains*: and it appears, from careful examination, that the united areas of these valvular portions are scarcely more than equal to the mean extent of the oval opening. One of the *curtains* (which, being least moveable, I have called *fixed*) occupies the left margin of the aperture in apposition with the *solid wall*,

* The left auricle is very liable to extreme dilatation, and to hypertrophy, and often when the communication through the mitral aperture is most confined: which circumstance seems to exclude the idea of any other source of forcible distention besides the arrested stream from the pulmonary veins. An auricle thus circumstanced, that would contain an orange of large size, and which has exerted great compression on the neighbouring parts such as I have many times seen, must furnish a strong testimony in favour of a distending venous current. It is now some years since I first found the left bronchus flattened by the pressure of the dilated left auricle; and this I continue, occasionally, both to find and to prognosticate.

† Or the additional muscularity may be acquired during some favourable nourishing interval in the dilating process; the enlarged cavity having a much greater effort to make, in order to propel its accumulating contents.

‡ See Fig. 2. Pl. 1.

from which arise all the cords that serve to secure the free edges and ventricular surface of the *fixed curtain*. These cords are of such a length, as scarcely to allow the *curtain* to rise into the plane of the oval opening, in the natural play of the valve, and, being destitute of muscular columns, cannot, by any possibility, set the valve in motion; or serve any other purpose than that of preventing too great a reflux of the curtain itself. A second *curtain* (the *anterior*) is attached at the anterior and right edge of the opening, having one free border forwards and another backwards in the ventricle*. Each border has its proper set of cords:—the anterior or upper set have their insertion into a mere nipple of muscle on the *solid wall*, in the direction of the pulmonary artery; and the inferior or posterior are as invariably collected with numerous others into the summit of a muscular column whose base is inserted into the thin right or *yielding wall* of the ventricle, near its centre; where also is attached, almost as regularly, another muscular band, which stretches across the cavity between the two walls. This band may have an average length of six or seven lines, and a circumference of three or four: it seems calculated to limit distention, and therefore I have called it the *moderator band* of distention. The third *curtain* or fold of the valve (the *right*) is situated on the right side of the aperture posteriorly, and has little or no connection with the inner (left) edge of the oval opening†. In extent and figure, it varies considerably; and it rarely forms one simple scallop, but is frequently fissured so as to form two or three, more or less complete. Its cords are accordingly arranged in two or more sets; the greater part of which are attached by the intervention of muscular columns to the outer or *yielding wall*, at a considerable distance from the *solid wall*, and usually without any transverse connecting bridge or *moderator band*.

Having concluded that all parts of the valve in connection with the *yielding wall* of the ventricle are affected by dilatation, I venture to call them *curtains*, *cords*, and *columns* of *distention*. The *anterior* and *right curtains*, then, are parts of

* See (D 1.) Figs. 1 and 2. Pl. 1.

† See (D 2.) Figs. 1 and 2. Pl. 1.

distention, together with the cords and fleshy columns attached to the *yielding wall*.

As it is seen in the left ventricle, so we may partially trace in the right, that each column is disposed to receive cords from the adjoining edges of two curtains. But it is desirable to notice, that the valvular insertions of the cords are more direct and widely scattered in the right than in the left ventricle; the object being, in the first, to restrain the curtains in one uniform valvular plane.

The anterior or *first column of distention*, with its *moderator band*, may be regarded as a constant formation. (D, Fig. 1. Pl. 1.)

A *second column* (E, Fig. 1. Pl. 1.) exists almost as uniformly, and often a third; but these columns of distention vary a good deal in size and arrangement. Frequently, the *first column of distention* is distinctly double; and sometimes there is a second *moderator band*.

: The length of the *columns of distention* is probably of very considerable importance. The *first* or larger column, in particular, sometimes reaches actually into the apex of the ventricle: (see D, Diagram 4. Pl. 1.) And if it be true, first, that the valve, in closing, tends to form a plane; and secondly, that distention deranges the *curtains of distention*; it follows, that the contraction of these columns must increase the derangement. This effect will be in exact proportion to the length of the columns.

It has been maintained by some, that the operation of the muscular columns is to prepare or arrange the curtains for their valvular closure; and this may be in part true with regard to the bicuspid: but since, in most animals, some parts of the tricuspid curtains have no columns, and since, in certain other cases, the columns do not exist at all, we may conclude that they are not essential to the nice adjustment of the valve. I think it will be fair to grant, that the muscular columns can have no influence on the valve, until the cords are more or less in a state of tension; which manifestly cannot occur until the curtains are stretched out in or near the plane of the opening. Probably, also, the curtains must elongate the columns, to prepare them for a full contraction. As a sail is swelled by the wind, and confined by its ropes, so these

curtains are extended by sanguineous pressure, and retained in the position required, whether for closure or for reflux ; while the contraction of the columns may compensate, in either case, for the systolic drawing-in of the walls.

Yielding of the Tricuspid Foramen.—Hypertrophy of the right ventricle, which is doubtless the result of a difficult circulation, is very frequently accompanied by some dilatation of the tricuspid foramen, as well as of the cavity.

Bouillaud deduces, by actual admeasurements, a *mean circumference* of the right auriculo-ventricular foramen, equal to 3 in. 10 lines, from three adult healthy hearts ; and one of 5 in. 2 lines, from five adult thickened and dilated hearts.

Now, it may be impossible strictly to prove that this aperture in the human subject may admit of distention during health ; although we find it every now and then morbidly enlarged, and not, as it would appear, from any weakness ; for the power of resistance is, on the contrary, rather increased. The contraction of the aperture, however, in concurrence with the general contraction of the ventricle, is shewn plainly enough in those cases in which the heart has been found to diminish its cavities by a degree of tonic contraction, when removed a few hours after death* (as hereafter to be related). It will appear, likewise, that simple congestion of the right ventricle is sufficient, in many animals, to dilate this opening. The most simple proof is furnished by some birds.

Assuming the circumference of the tricuspid opening to be capable of relaxation under distention and during health, we must consider that the valve will participate in the alteration ; but as the yielding will take place almost entirely in the right or feeble margin, the displacement will only affect the curtains attached to this part (namely, the *anterior* or second, and the *right* or third), which is a good deal more extensive than that formed by the solid wall. (See Fig. 1. Pl. 1 ; and D 1, and D 2, Fig. 2. Pl. 1.)

Under these circumstances, the term *curtain of distention* will include still more of the valve, or nearly two-thirds of its circumference.

* Pages 130, 131, 137, and 139. See also Experiments on Animals, Part 2.

SECT. 5.—THE OPERATION OF THE SAFETY-VALVE.

We are now prepared to enter upon the consideration of the proper function or operation of the tricuspid valve; concerning which, I find that Richerand, in his "*Elements of Physiology**, " has the following remarkable observation:—"On the point of death, the lungs expand with difficulty; and the blood sent into them, by the contractions of the right ventricle, being no longer able to circulate through them, collects in that cavity, flows back into the right auricle, in which the veins continue to deposit blood, stretches their parietes, and increases considerably the dimensions of their cavities." He observes, however, in continuation, that "regurgitation is prevented by the tricuspid valve;"... "but that a certain quantity of reflux precedes the perfect closure of the valve†: and besides, the three portions of the tricuspid valve do not close completely the aperture around which they are placed; they are perforated by a number of small holes: a part of the blood, therefore, returns into the auricle, but the greatest portion is sent into the pulmonary artery." These perforations, however, must, I think, be exceedingly rare.

The works‡ of Harvey and Hunter contain distinct allu-

* Chap. 3. § 51. The 4th edition, by Dr. Copland.

† For the elucidation of this very reasonable opinion, see the state of the tricuspid curtains in Fig. 1. Pl. 1; which may be supposed to shew an exaggerated degree of openness in the valve, as produced by the simple afflux of blood; and in the same manner, likewise, the quantity of regurgitation that must be produced previous to the accurate closing of the curtains together, whilst they are falling back, and the systole is proceeding.

Dr. Reid has detailed, in the *Edinburgh Medical and Surgical Journal*, April 1836, a number of experiments, in which the right side of the heart being found congested in animals poisoned or hanged, it was shewn that venesection, soon after the heart ceased to beat, at once relieved the right ventricle, and excited its pulsations. This would seem to shew both that the distention is powerful, and that reflux is necessary. The experiments were all performed on animals with the smallest share of safety-valve apparatus.

‡ "Ideò valvulæ istæ mitrales, mole et robore, et exactâ clausurâ, illas in dextro positas exuperant." *Harvey, De Motu &c.*

"I have reason to believe that the valves of the right side of the heart do not so perfectly do their duty as those of the left: therefore we may suppose it was not necessary." (*Hunter: Animal Econ.*) Hunter here includes the pulmonary sigmoid valves.

sions to the feeble or imperfect action of the human tricuspid valve; and some subsequent writers have made a similar admission*.

This is a fact which I have stated to be manifest enough, even on making a superficial examination of the part; but especially certain on drawing a careful comparison between the valves of the right and left side. I have shewn, that, upon injecting fluids into the ventricles by their respective arteries (the sigmoid valves being destroyed), the left or bicuspid valve was always seen to close completely and firmly; the curtains being so extensive as to fold together in the form of a cone or wedge within the ventricle, whilst the tricuspid was constantly found in its ordinary state, incapable of preventing a considerable reflux. With every attempt to induce an accurate closure of this valve, its scanty and divided curtains united imperfectly or scarcely met, and were only sufficient, at the best, to form a plane equal to the area of the opening.

The construction which I have described, in connection

* Dr. Adams of Dublin has expressed a very distinct opinion in favour of a safety-valve, yet without adverting to the cause or the mode of its operation.

Of the jugular pulse he says: "To me it appears most probable, that it results from the regurgitation of blood from the right ventricle into the auricle, by which the current descending from the jugular veins is repelled back into these vessels during the systole of the ventricle."

Dr. Adams, adverting to the older remark of the imperfect closure of the tricuspid, states very forcibly, "that, in his opinion, this circumstance has not been sufficiently noticed, nor the influence that such a structure may have on the circulation in its natural or morbid state considered. I look upon this difference of the valves of the right and left side of the heart to be a natural provision, to allow of a partial reflux into the right auricle, on those occasions when, from any cause, the passage of the blood through the arterial opening is retarded. Such a provision was absolutely necessary in the right or pulmonary ventricle; as various natural causes must momentarily retard the passage of the blood through the lungs."—See the Dublin Hospital Reports for the year 1827, pages 436, 7, 8.

I am glad to insert these quotations with the first publication of my own views. A Letter from Dr. Adams, during the last summer, was the first intimation I received of his opinion; which, however, had been long advanced in his valuable paper, entitled, "Cases of Diseases of the Heart, with Pathological Observations." I may be permitted to state, that Dr. Adams does not assign any cause for the regurgitation, unless it be dilatation of the auriculo-ventricular aperture. He exposes clearly the facts of delay and accumulation in the right ventricle, and the necessity of a reflux.

with the *yielding wall* of the ventricle, constitutes the main peculiarity of arrangement and action in the tricuspid valve; the great extent, thinness, and feebleness of the *yielding wall* rendering it liable to the distending influence of venous accumulation in various degrees; the curtains being three, and each one being tethered to that part of the ventricular paries immediately beneath itself (but most extensively to the *yielding wall*), by the intervention of columns, whose passive effect is to produce a retraction of the curtains in proportion to the distention, and whose active contractions serve, under dilatation, to augment the valvular retraction, or rather to maintain it at its height during the imperfect systole. The number, extent, and power of the *columns of distention* are therefore of great importance to this function, as well as the natural limited extent of the tricuspid curtains. And further, the orifice itself, depending upon the *yielding wall*, may admit of some relaxation, and thus assist to produce regurgitation.

The anatomical demonstration of all these structural peculiarities is sufficiently easy and plain, and the experimental proofs of their necessary effects seem to be equally forcible; whilst the extensive application of the facts appears to be of the highest importance in the physiological and pathological considerations of the circulation.

Experiments illustrating the Operation of the Safety-Valve. Taking a human heart from a body dead within about 24 hours, and in which I could discover no material morbid change of form or substance, I proceeded to remove portions of the sigmoid or semilunar valves of the aorta and pulmonary artery, and to fix tubes into these vessels, with a view to inject the ventricles. I next cut away a large part of the auricles, so as widely to expose their communications with the ventricles: and now, upon injecting the left ventricle through the aorta, the mitral valve became at once firmly closed, and, as seen through the auricle, presented very much indeed the appearance of a continued suture, with a slight prominence or tense bulging sac on either side. The pressure of the syringe and distention of the ventricle being maintained, nothing escaped. Great force was required to disarrange this state, and produce a

narrow thready jet. After this, proceeding to the injection of the pulmonary artery in the same manner, and slowly filling the right ventricle, it was quite impossible to produce a similar effect. No position in or out of water, no degree of gentleness or force, no state in anywise natural to the organ that I was able to induce, would prevent a considerable ribband-like stream of regurgitation between the ill-apposed edges of the valve.

Independent of earlier and less careful attempts, I performed the same experiment, with various modifications, upon at least ten or eleven different adult hearts, and all of them seemingly healthy. The result invariably tended to the one uniform conclusion.

I shall, however, before advancing, advert to several circumstances of deviation, that occurred in the different repetitions of this first experiment.

The bicuspid valve has occasionally been somewhat less perfect than is described above. In some of the hearts experimented on, it has allowed one fine jet of regurgitation, or even two—in consequence, as it might seem, of some original imperfection; since it resulted alike from a slight and a considerable distending force: and I have seen the same result in other experiments, performed upon valves that were evidently unsound; as, for example, opaque, thickened, and uneven. The same effect, also, has been produced, when the left ventricle was moderately distended, by pressing on its surface, in such a manner, and at such a point, as to relax some of the tendinous cords.

To render the experiment on the mitral valve most strikingly characteristic, the coronary arteries should be secured with ligatures, and a stop-cock employed. With these precautions, the auricle being laid freely open, the ventricle may be distended, until it becomes quite full and hard, and the tumid auricular surface of the valve resists considerable pressure of the fingers. After closing the communication at the aorta, this turgid fulness of the ventricle will persist, for a long time.

Whilst examining the right side of the heart in the preceding experiments, the only possible means of obtaining a nice though weak adjustment of the tricuspid curtains was,

to compress the ventricle, and by the same means to lessen the extent of the valvular aperture. Without this unnatural influence, before the ventricle became full by slowly injecting it, the fluid escaped, by regurgitation, into the auricle: indeed, I have seen, on several occasions, in hearts perfectly healthy (setting aside the simple congestive fulness of death), that the acting tricuspid valve presented an angular aperture, nearly equal in area to that of the pulmonary artery.

I infer, that, in the experiments of which I am now speaking, the right side of the heart had been in most cases somewhat too full of blood, and certainly in no case was it greatly contracted; consequently, the results, and the explanations deduced, are most applicable to the living ventricle, when in a state of undue fulness.

Whilst the injection of the right ventricle is slowly proceeding, every thing being arranged to free the cavity from all other extraneous influence, the curtains are seen to extend themselves, and incline towards each other and the plane of the opening; and the reflux continues excessive, until they approach one another, to a certain degree, by the pressure of the fluid accumulating behind them: and often, with the continuance of the injection, the stream attains the form of a band from one to eight inches in height, of greater or smaller size, probably depending upon the degree of actual fulness of the cavity during the last moments of life.

Here I may observe, that the action of the larger muscular columns is wanting, the curtains are seen extended well across the opening and almost meeting, and it is not possible to imagine that the columns could do any thing to favour a nicer adaptation: but it is very easy to understand, that if the valves should be accurately adjusted, the contraction of the columns, concurring with and being nearly equal to the systole, would retain the curtains in their true valvular position, and thus compensate for the falling in of the wall, which alone might tend to make the curtains flow back further than is consistent with their peculiar object: and, on the other hand, if the effects of dilatation prevail, we must see, that while the systole tends to restore the true valve, the accompanying contraction of the columns serves to

counteract the contraction of the wall, and to maintain the safety-valve.

Having entertained the idea, that the state of the left ventricle might affect the function of the right valve, I contrived, by the help of the stop-cock, to retain the left ventricle in a state of distention; but this did not seem to produce any alteration, in the result of experiments, on the right.

I have already noticed the more direct and scattered insertions of the tendinous cords into the tricuspid curtains, affording them an uniform support, when the three unite, by their margins, to form one oval layer in the plane of the auriculo-ventricular opening. The varying lengths of the cords are likewise adapted to this effect; and these few scattered and, as it were, additional attachments of the cords have a tendency, when the valve is in operation, to render its auricular surface both pitted and nodular.

It will naturally strike the physiologist, who may be induced, in opposition to a settled opinion, to give any attention to these statements, that conclusive experiments can only be made upon the living heart*; and I have not been unmindful of the force of such an opinion. I have twice had an opportunity of experimenting on the human heart at the earliest period that propriety could admit of. In one of these cases (of which I have not hitherto spoken), after performing the experiment and eliciting results similar to those related, the heart was set aside, with the expectation that its *tonicity* would gradually contract the ventricles and fleshy pillars; which accordingly occurred. The first trial of this heart was made with warm water; and the fluid was thrown in, at first gently, and afterwards pretty forcibly; but the regurgitation at this time was always considerable. Now, upon repeating the experiment on the same heart, when contracted after the lapse of a few hours, the tricuspid valve was found to be much less incomplete: still;

* There is, notwithstanding, one very powerful reason for concluding in favour of the experiment upon the heart some hours after death. For if the tonic contraction of the heart has not been able to effect the condition necessary to a true valvular action, what was to have been expected during life? Those will best understand this view, who have examined the soft and flaccid ventricle, during the intervals, and upon the cessation of its contractions.

in this case there was some reflux stream. In the second case, however, under precisely similar circumstances, I obtained, at last, an almost perfect valvular action: though even this could not be maintained for half a minute without renewing the injection, as it continually gave out a little stream, which did not exceed that of the least accurate adjustment of some one or two mitral valves on which I have experimented, regarding them as healthy.

This, to me, was an unprecedented instance of true valvular action in the right side of the human heart; though so feeble was it, that the slightest pressure of the finger was sufficient to displace the curtains.

Although I believe what has been described to be strictly true, I am inclined to suppose that, at a certain point of the natural ventricular systole, the action of the tricuspid valve is very nearly complete. On the other hand, I am convinced that, in all cases in which the right ventricle is, in any material degree, temporarily distended or permanently dilated, the heart and lungs are relieved by a considerable reflux of the ventricle's contents into the auricle and systemic veins. It is highly deserving of notice, also, that the more accurate closure of the mitral valve seems to have a like necessary reference to the safety of the lungs; the least backward-current in the pulmonary veins being strictly obviated. A very limited acquaintance with disease must set aside all uncertainty with regard to the fatal mischiefs which follow the imperfect operation of the mitral valve.

I have ventured to regard the apparatus, which regulates the right auriculo-ventricular aperture of the heart, as a safety-valve, rather than a simple valve; or more properly, as both the one and the other, on different occasions. Of course, it is impossible to estimate the precise relation and quantities of these two different functions. It may be imagined that the real proportion of reflux is exaggerated in the preceding exposition; and it must certainly vary much in different human hearts, according to their state of contraction, and still more in the hearts of different species of animals: but whereas a few simple examinations and experiments will suffice to establish the conviction of the physiologist for or against the principle of a safety-valve action,

no labour, in the present state of science, probably, would enable us to attain a knowledge of the exact degrees of reflux by this incomplete valve.

With respect to the operation of the tricuspid valve in the living man, it will be difficult to furnish more satisfactory data than have been already produced*.

A variety of circumstances, however, remain to be stated, in connection with the same kind of experiments performed on the heart in different states of health and disease; which will be best introduced by reference to particular cases.

It is remarkable, that, in post-mortem examinations of the heart, it has not occurred to pathologists to test the action of the valves by means of injection. If it should be advanced, that the test could not be considered as conclusive, it would probably be a sufficient reply, to produce the facts of the widely-varying results: but to do this, beyond a very limited extent, would be inadmissible in this place†.

* If any one were inclined to infer, that whatever reflux occurs by the tricuspid or safety-valve should be manifested by the pulsation of the jugular veins, I would observe, that such is not to be expected as a common result, and for the following reasons: The over-distended ventricle has lost something of its power—the accumulation within it is a material source of increased resistance—the imperfect systole is partly expended in sending blood to the lungs—and the refluxent overplus is driven into the capacious auricle, and scarcely less capacious cave: in which, when any diastole is produced, it should not be very remarkable, and, of course, the dilatation of the superficial jugulars would be less forcible; these vessels being still more remote, and much assisted in transmitting their contents by the forces of gravity and inspiration, and by the play of considerable valves. All these circumstances tend to preserve the circulation of the brain and senses, &c. Most physiologists must be aware how mysteriously the older vivisectioners regarded the pulses of the abdominal cava. It is not very difficult to understand, that when distention has subverted the action of the jugular valves, the refluxent pulse becomes so exaggerated as to be both seen and felt.

It scarcely needs to be explained, that when, from an increased distention, the jugular valves cease to act, the refluxent pulse in the neck is manifest enough. It should, however, be remembered, that a reclining posture and the intervals of inspirations render the pulsation more remarkable. The valves form no obstruction to the filling of the jugulars by injection.

† The great and variable capacity of the venous system, in certain parts of the body, appears to render it peculiarly adapted to the purposes of a reservoir, under circumstances of delay or repletion; and the deficiency of valves favours this view. It is surprising that physiologists should ever have

I have been accustomed, for some time, to examine the ventricular valves, in the manner described; and I feel at a loss to imagine what kind of pathological history or reasoning could be credited, relative to the living operation of these parts, without the test of injection. Experiments of this kind, performed upon hearts more or less evidently diseased, produce some results that would lead us to conclude, that if the theory of a safety-valve in the healthy man be thought groundless, it is still essential to retain some such opinion as to disease; for the very different states in which the right ventricle and its valve are found, in connection (both as to cause and effect) with derangements of continuous parts in the course of the circulation, is already a fruitful subject of investigation.

Both the valve of the left and right side may thus be found perfect or imperfect, in an unusual manner, even when we should otherwise be quite unable to decide on their being so, or ready at once to determine differently.

The mode of performing the injection has been little varied. Sometimes a longer tube has been carried into the ventricle, in order not to destroy the sigmoid valves. Very frequently the hearts have been placed in water during the experiment, to obviate any unusual pressure: and this is a very convenient method; for the auricles being widely opened, the natural position of the heart serves best to allow

have maintained that veins are inelastic. In the dissecting-room, the distinguishing character of a vein is its superior powers of extension and retraction. The longitudinal folds formed by the lining of the empty veins affords a very marked appearance in the leg, especially of the young. To inflate some veins, and then to observe their ready contraction, would convince any one of their elasticity. Other veins, however, as those about the spine, possess much less proper elasticity, although they are evidently adapted to receive widely-different quantities of blood. Those in the spinal canal appear to me to be well contrived to become filled when the medullary canal is extended, in the flexions of the trunk, and to let out their contents when the capacity of the elongated cavity is diminished, whether suddenly or not, in resuming the upright posture. This arrangement is still more striking in various inferior animals with flexible spines, and especially in the oetacea. In the seal, a great part of the medulla would appear changed into a slight *cauda equina*, to make room for those sinuses which occupy at least three-fourths of the canal. A similar formation exists in the porpoise, in front of the medulla; whilst in the seal the sinuses are immediately beneath the arches of the vertebrae.

the escape of the reflux fluid, and the adaptation of the valves is the more distinctly seen. The diameter of the tube of the syringe, in all my experiments, has been rather less than the fourth of an inch, and often still smaller; and that of the piston about four inches.

The following notes are parts of the histories of post-mortem examinations, which were taken long after the preceding accounts. They are abstracted with a view to illustrate various opinions and results that have been already stated. Some points of anatomical arrangement are recorded, with a view to explain both the common and unusual circumstances, as well as to shew what parts most require notice. Remarks are added to some, for the sake of illustrating certain effects and peculiarities, which appear to me of essential consequence. In each case, the most fatal and important features of disease are subjoined, in order to shew the nature of the death. I have considered the hearts to be quite healthy, whenever it is not otherwise stated.

On the 10th of December, 1835, I made an examination that afforded a remarkable instance of simple distention of the right ventricle from pulmonary obstruction, in a female aged 20. Within three weeks, a chronic pleuritis was followed by acute inflammatory effusions, both fluid and solid, and in great quantity on the right side of the chest. The lung here was reduced and airless; but its large vessels, as well as those of the left lung, were full of dark blood. The left ventricle seemed rather small, and was empty and contracted, but not very firm: its auricle contained a few drams of coagulating blood. The right side of the heart was immensely distended. The right ventricle, large and rounded, seemed actually capable of containing the left in its cavity. The pulmonary artery was roundly distended; its dark* contents partially appearing through its coats.

Here was no disease of the heart—no room for the influence of pulmonary resilience. The obstructed lung, and the force of the venous afflux, were the causes of the extreme distention of the right ventricle.

* This was within six hours of the patient's death

John C——, of middle age: examined six hours after death.

The right ventricle, especially towards the pulmonary artery, was considerably distended: the tricuspid gave considerable reflux (upon injecting warm water by the pulmonary artery); the parts being warm, and the blood almost entirely fluid. On the following day (the heart being set aside to contract) the valve was still very imperfect; at the same time, the cavity was moderately capacious and thick. The first *column of distention* had rather a limited *moderator band*. A second *column of distention* was very slender and insignificant, and attached to the *solid wall* *. But there was a third *column of distention*, a good deal controlled by the *yielding wall*.

The left ventricle was a powerful and healthy cavity.

The general and fatal affections were—Urinary inflammations—acute dysentery. The spleen and lungs were also affected.

Henry H——, aged 26: examined seven hours after death.

The heart was excessively distended; even the left side considerably. The tricuspid acted most imperfectly; and the bicuspid was much less accurate and firm than usual. The right ventricle was rather thin, but the left was scarcely so. Besides a slight looseness of the muscular substance, there was no evidence of disease.

There was one *column of distention*, with a long *moderator band*; and there were two or three other very slight *columns*.

The death of this person was connected mainly with old disease of the knee, leading to amputation seven or eight days before death; and renal disease.

William P——, aged 24: examined twenty hours after death.

The heart was of good size; the right auricle distended, and the ventricle full. The left auricle was rather full, and the ventricle contained but little. The pulmonary artery was full; and bluish, from its transparency. All the valves were healthy in structure. Under experiment, the tricuspid curtains rose into a plane, but their closure

* This is quite abnormal.

was very incomplete in all stages of the injection. The cavity of the right ventricle was of moderate extent. The wall was solid, and, in the first evident degree, hypertrophic. There were two considerable *columns of distention*; both rather short. The first had two limited *moderator bands*; and the second gave off, from near the base, an oblique band towards the apex of the solid wall. The mitral valve acted with much power and accuracy.

It is very difficult to suppose, that with less extent of the right ventricle the tricuspid curtains would not have closed better in this case.

The chief morbid circumstances were—Renal anasarca—large spleen—indurated liver—slight pulmonary congestion—sudden death, probably from the tumefaction of the glottis.

Henry P——, aged 51, ill fifteen weeks: examined forty-eight hours after death.

The right ventricle contained a very moderate quantity of blood, fibrinous, and firmly coagulated*. The cavity was perhaps somewhat contracted, though by no means small: its parietes were thick. The tricuspid valve admitted rather a considerable regurgitation. There was one large and almost triple *column of distention*, with a very lengthened *moderator band*; and there was a smaller *column of distention* attached near the septum. Some parts of the edges of the tricuspid valve were opaque and thickened, without being indurated or contracted.

The left ventricle was strong, and the arteries diseased.

The affections which produced death were—Urinary obstructions, and inflammations—phthisis, and arachnitis. The spleen and liver were disordered.

The nicest adaptation of these valves can only be understood by the observation of them in experiment; but to me, it seems very natural that, in this case, the vital action of the parts might have been sufficient to render the adjustment of the curtains more accurate, if not close or firm.

* The free opening in the auricle readily admits of the removal of these portions of fibrin.

Susan P——, aged 23 : examined twenty hours after death.

The heart was small, and seemingly wasted. The ventricles were, however, firm, and of sufficient thickness, in comparison of the whole : their cavities were of moderate size. On injecting, the left valve was strong and perfect : the right appeared to have extensive valve-curtains ; yet the injection escaped between them pretty freely.

There were two large *columns of distention* ; each having a rather short bifurcated base, uniting it both to the *solid* and the *yielding wall*.

This patient was worn out by chronic peritoneal and intestinal disease.

As in the foregoing case, I would conclude here, that very little was wanting, to the wide extent of curtains and limited cavity, to effect a true valvular action ; and, indeed, a brisk ventricular systole would probably be propulsive enough, with such a valve.

Priscilla W——, aged 20 : examined five hours after death.

The right ventricle was by no means distended : it was of moderate thickness and capacity. On injection, its valve gave considerable reflux ; and with some increase of force, there were two band-like jets, rising two or three inches. On repeating the experiment the following day, the reflux seemed to be somewhat diminished.

There was one *column of distention*, with many *cords*, and a very limited *moderator band*. There was a second *column of distention*, small, and far removed from the *solid wall*.

The left side of the heart, at the time of inspection, was nicely contracted.

The chief serious conditions were—Icterus, and acute hepatitis, terminating with coma.

In this case, the most favourable operation of the valve was pretty good : the strength and capacity of the ventricle, together with the arrangement of the curtains of *distention*, seconded this effect ; and a subsequent diminution of the ventricle improved it. Had the cavity been in a state of distention, would it not have been otherwise ?

Joseph N——, aged 40: examined twenty-three hours after death.

The heart was involved in firm adhesions. The right ventricle was large; but the dilatation was chiefly in the direction of the pulmonary artery, and acted less upon the *columns of distention*: its parietes were greatly thickened. The tricuspid valve acted with unusual accuracy and firmness: its curtain was very extensive, and slightly thickened. When acting, it formed a pretty simple plane. There was one *column of distention*, with a rather short *moderator band*; and two other columns planted upon short *moderator bands*, and very little liable to be affected by distention. The pulmonary artery was capacious, and its valves perfect. The left ventricle was large, and hypertrophic. The bicuspid valve, when tried by injection, was seen to act imperfectly; and its margins were a good deal thickened. The left auricle was capacious, and thick.

The fatal circumstances, in addition, were—Bronchitis and hæmoptysis—inflamed and tubercular lungs—affected liver, and anasarca.

Here are the circumstances of disease, the action of the right ventricle being too strictly and forcibly propulsive. The hypertrophy of the cavity had resisted the tendency to distention: its strength, with an arrangement of its valve congenitally, very unfavourable to a safety-valve action (and a probable cause of the hypertrophy), must, at least, have aggravated the diseases in the lungs. The state of the left side of the heart was a material cause of obstruction. The dilatation resulted, as I conclude, from the powerful injection from the right ventricle. The mitral valve was weak, in consequence of the ventricular dilatation, and the traction exerted upon its cords.

D. E——, aged 42: examined twenty hours after death.

The heart was very fat, large, and powerful: the right side rather empty than full. Upon injecting by the pulmonary artery, the tricuspid was seen, in the auricle, to form a very uniform plane; and the curtains united neatly, so as to admit only three inconsiderable streams of reflux. This heart being set aside in water, the reflux was certainly

diminished when the injection was repeated the next morning. The parietes of the right ventricle were thick, and the cavity of moderate size. There were two large columns of distention; and the first had a pretty free moderator band.

The bicuspid valve under experiment gave back one or two slight jets: its curtains were somewhat thickened, and perhaps contracted.

In this case, two or three old chronic vomicae seemed to be the source of hæmoptysis, which became suddenly fatal. There were also some liver and renal affections.

The remarks relative to the stronger propulsion of the right ventricle, in the case of Joshua N——, might apply here; but we must not conclude that the cavity was incapable of dilating, nor that a very moderate distention would not have produced a copious reflux. A greater degree of fulness, or a less complete tonic contraction, might have left a less accurate valve.

I trust that I have thus sufficiently explained the theory of a safety-valve, and the importance of the function, as regards the circulation both in health and disease. For the pathologist, however, much more remains to be advanced: but this must be deferred; as it is more important, at the present moment, to produce some other arguments, which may serve to establish and extend these opinions.

As a summary of what has been already stated, I trust there is some force in the following deductions:—

That the powers of the venous circulation are variable—sometimes great, and occasionally excessive.

That the circumstances of repletion and obstructed respiration may alike vary in the same manner.

That the right ventricle is liable to varying degrees of distention.

Lastly, that the tricuspid valve, naturally weak and imperfect, closes less and less accurately, according to the increasing degrees of the ventricular distention.

The demonstrative evidence of the last inference may possibly be considered as altogether deficient; but I believe

that an accurate knowledge of the structures, and the different appearances which they assume, in several particular modes of death, will go very far to establish its justness.

The striking and curious varieties presented by the same parts in animals, I have supposed to form the most unexceptionable and, indeed, astonishing evidence of the opinions here maintained. The examination of the function under consideration, both in the Mammalia and Birds, has been pursued very much after the same manner as in the human subject. I have had very numerous opportunities of examining the hearts of living animals, by injection; instances of which will be occasionally introduced: but the space obliges me to confine myself as closely as possible to the anatomical exposition of the singular gradations of the safety-valve, which I regard as furnishing the most forcible testimony.

PLATE I.

Fig. 1.

Is taken from a Preparation of the Human Heart at birth. It presents, I think, the simplest characters of the tricuspid valve belonging to the species: it is, however, distended, and the *yielding wall*, naturally thick at this period, somewhat reduced. There are two *columns of distention*: the anterior one has a distinct and rather limited *moderator band*, whilst the posterior one depends solely on the *yielding wall*. The fixed curtain is concealed. The references are the same as in Diagram 4 and Fig. 2; and it will be found, throughout these descriptions, that the same letter indicates the same part.

Fig. 2.

Represents the Tricuspid Valve in its closed state, as seen in the right auricle. It is not pretended, however, that this is a strict representation, the appearance being so transitory and varying. The interior of the auricle is naturally delineated; and the valve appears closing against the current which is escaping from the ventricle just becoming filled. The three curtains form one plane, separated by a fissure, which is here and there distinct; for the scantiness of the valve, as well as its arrangement of cords, prevents all tendency to the union of the curtains by flat surfaces, as in the mitral valve. The edges only are approximated, the curtains are flat, and scarcely tense. The fissure is shewn in a mean state of closure. The effect of any degree of distention behind the curtains would be to render them more nodular and irregular,

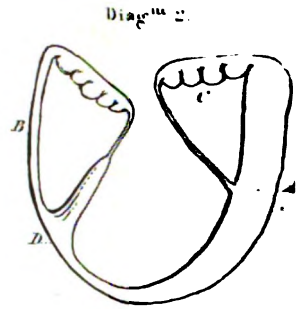
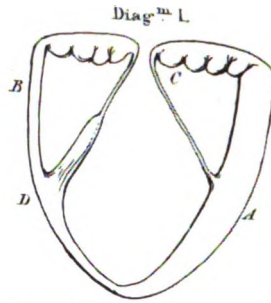
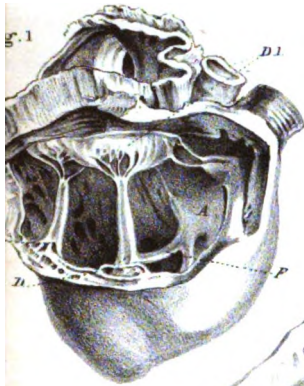


Fig. 2.

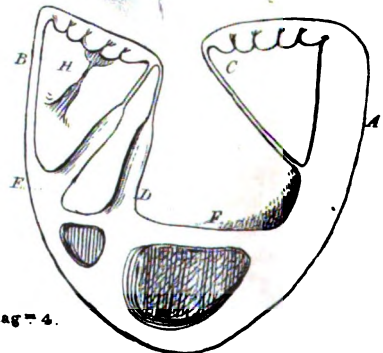
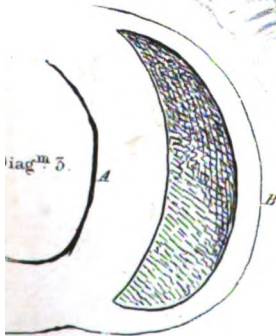
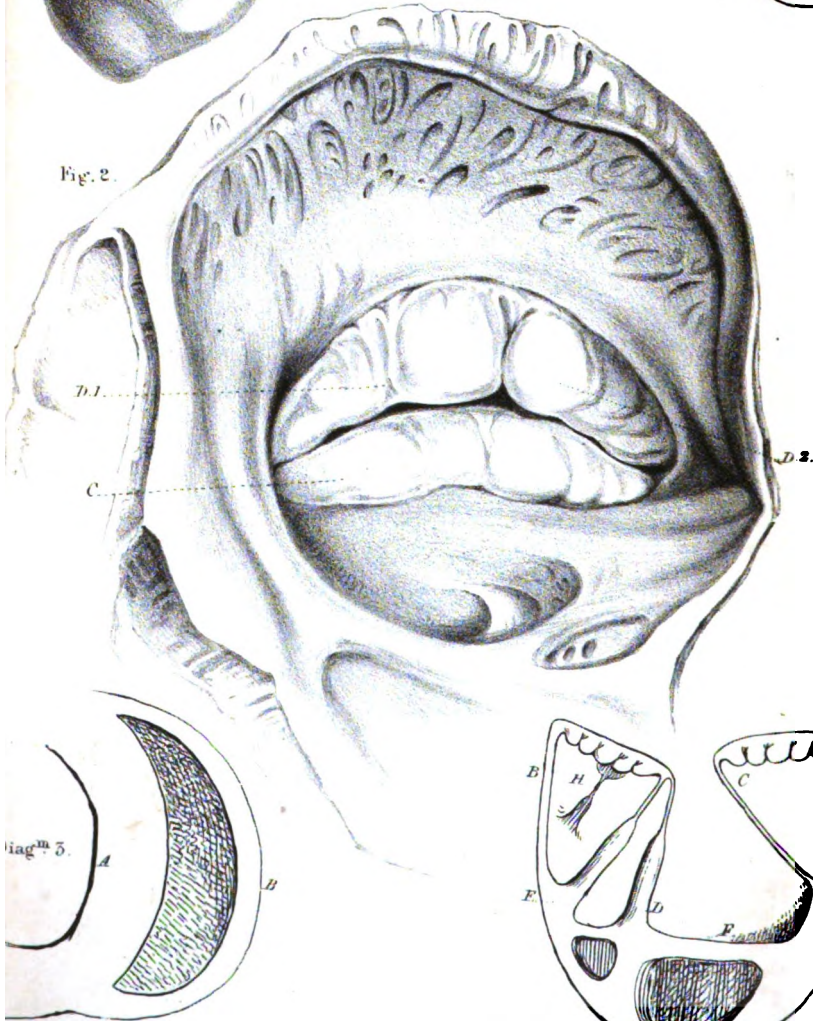


Diagram 4.

gular, and to widen the breach. The effect of dilatation—the retracted and disturbed curtains, and the widened aperture with a copious reflux—could not possibly be represented in a drawing.

- C Is the fixed curtain.
- D 1 The anterior curtain of distention; and,
- D 2 The posterior.

The *Diagrams* 1, and 2, represent the simple elements of a Safety-Valve.

- A Is the solid wall of the ventricle.
- B The yielding wall.
- C The fixed curtain, and its cords; represented by a single one, with a mere rudiment of a muscular column for its base.
- D The column, cord, and curtain of distention.

No. 1. shews the appearance of the valve when closing against reflux in the ventricular systole: the edges of the curtains should become nicely apposed.

No. 2. shews the effect of distention; the yielding wall carrying out the apparatus of distention by retraction of the column D.

Diagram 3. is an outline taken from a transverse section of the heart, about one inch and a half from the apex. It is pretty accurate only as relates to the form of the cavity of the right ventricle, and to its adaptation to the solid wall A.

Diagram 5. shews all the essential parts belonging to the Safety Valve in Man.

It is a section of the ventricle; shewing,

- A The septum or *solid wall*.
- B The right, thin or *yielding wall*.
- C The fixed curtain, and its cord (one, instead of many).
- D, E, & H, The *columns of distention*.
- D The *first* very long; and connected with
- F The *moderator band*.
- E The *second*, secured to the outer *yielding wall*.
- H The *third*, still more remote from the *moderator band*, less constant in its appearance, and smaller, but connected very much as the preceding.

The effect of distention is also seen; the *yielding wall* having fallen outwards, and produced a retraction of the *columns, cords, and curtains of distention*.

PART II.—OF THE SAFETY-VALVE IN THE MAMMALIA.

A GENERAL ANATOMICAL ACCOUNT OF THE VALVULAR APPARATUS, AND THE PRINCIPLE OF ITS GRADATION.

I have felt assured, that the experiments which I have performed warrant the assumption of a safety-valve action of the tricuspid valve in most mammalia—an action dependent upon the arrangement of the parts which, in the foregoing sections, have been called the *curtains*, *cords*, and *columns of distention**; that is to say, upon the attachments which the valve has towards the *yielding wall* of the ventricle: and in explanation of this conclusion, I proceed to shew, that we find these same attachments very various in different animals,—many, or few, or none, according to the following principle.

There exists, in the several orders, a *moderator band*, or cylindrical cord, of greater or less importance, traversing the cavity of the right ventricle, from near the centre of the *septum* to the opposite point of the *yielding wall*. This *band*, which is generally considerable, seems of some use, as I have already explained, to moderate the degree of healthy dilatation; and it is found to be mainly connected with the *columns of distention*, which are attached about either of its extremities, or intermediately, as the case may be. The *curtains of distention*, by means of their *cords* and *columns*, are attached, in one case, to the left extremity of the *moderator band*, and into the *solid wall*: in a second case, they are secured to the middle part of the *band*, between the two walls: and in a third case, their attachments are into the *yielding wall*, at or near the yielding end of the *moderator band*. (See Pl. 2. Diagr. 1.)

It will be evident, that, in proportion as the *columns of distention* are attached close to the *solid wall*, they must be the less influenced by the yielding of the outer wall: and,

* In seeking to describe succinctly the operation of unnamed parts, there has been no choice, but to name them; which I have ventured to do, in accordance with the principle to be maintained. The nomenclature, however, in the case of man, is too simple to be complained of; but as the function, and its appropriate organs, are gradational in animals, it must be expected that the terms will be more or less justly applicable, as the degree of the function may happen to be great or small in any particular case.

on the contrary, it must be sufficiently apparent, that the more the *columns of distention* are secured away from the *solid wall*, and near to the *yielding wall*, so much the more is the influence of distention left to operate freely in displacing the valves, and producing reflux.

First, then, in certain instances it is found that the *curtain of distention*, or all that portion of valve attached to the outer edge of the right auriculo-ventricular foramen, is secured by numerous cords attached about its floating edge; and that these cords are collected into the summits of two or more muscular columns, which are inserted into the *solid wall*, and therefore totally unaffected by any displacement of the outer wall. (See Pl. 2. Diagr. 1. Column 1; and Fig. 1.)

In the second place, or stage of progressive development, we may suppose the *columns of distention* inserted into the transverse *moderator band*, near the *solid wall*: in which case, they can be but slightly affected by the movements of the *yielding wall*. (See Pl. 2. Diagr. 1. Col. 2. & Fig. 2.)

Thirdly, the *columns* are inserted into the same band, at a greater distance from the *solid wall*; and consequently more subject to the influence of distention; which, acting on the *yielding wall*, extends the *moderator band*, and carries out the *apparatus of distention*. (See Pl. 2. Diagr. 1. Col. 3; and Pl. 1. Fig. 1.)

Lastly, the *columns of distention* are inserted into the *yielding wall*, at or beyond the corresponding attachment of the *moderator band*: in which case, the results of distention are still more considerable. (See Pl. 2. Diagr. 1. Col. 4; & Fig. 3.)

The healthy dilatation of the right ventricle must of course result from the limited strength of the *yielding wall*: and it is necessary here to remark, that the thickness of this part (most fairly estimated by comparison with the left) seems to vary considerably, both in quadrupeds and birds.

Other elements of an imperfect or safety-valve, which have been distinguished in the human heart, are also found to perform their part in the general animal series; namely, the form of the columns, the proportional extent of curtain, and the yielding nature of the auriculo-ventricular foramen, whose resistance, in all probability, is in equal proportion to that of the *yielding wall*.

Some notice of these peculiarities must necessarily be introduced, as they occur in the successive grades. According to the most remarkable varieties of safety-valve formation, the Mammalia may be arranged in four separate, but successive series. Perhaps the animals with divided ventricles, or bifid hearts, should form a fifth series.

FIRST SERIES.—I have said, that the *columns of distention* may be inserted into the *solid wall**, more or less remote from the *moderator band*, whose office here appears to be of little consequence; and the band is therefore very slight, or it merges almost imperceptibly into the union of the two walls anteriorly. With the above arrangement, as experiment will shew, the valve does not always act closely, unless the ventricle be in some degree contracted; for the natural distention, quite independent of any force in experiment, may slightly enlarge the tricuspid foramen, and thus disturb the valve, chiefly by reason of the scantiness of its curtains; but there is no displacement of the *columns of distention*. The safety-valve action is at its lowest point, though not, I presume, totally obviated; so that the general terms which have been employed may still apply, but at their lowest value.

This arrangement I have found to belong to most rodent, canine, and marsupial animals, and likewise to some others allied to them; but even this is varied so gradually, as to present a succession of stages, inclining to the more distinct form of a safety-valve adjustment.

I have selected one form; which may serve to characterize the series, and at the same time assist to explain its variations: it is from the hare †.

In the hearts of this series, the *columns of distention* are usually more than two, and often as many as four, in number; and they increase in size from behind, forwards; the posterior being comparatively insignificant. It is the anterior, or larger one, whose variations are chiefly remarkable ‡.

The valve here, and in many hearts of the succeeding

* As column 1, in Diagr. 1. Pl. 2.

† See Fig. 1. Pl. 2. with its description.

‡ A still more anterior attachment of one cord can scarcely be considered a column. See Fig. 1. Pl. 2.

series, will not strictly admit the application of the term 'tricuspid'; since there is a little cuspid process, or curtain, between each two adjoining columns. The anterior column appears, in this series, to increase in size, nearly in the same ratio as the remainder decrease in number and importance. Its precise relative dimensions, together with the nature of its connection to the *moderator band*, are all the particulars here requiring attention.

It will be seen, that in the hare all the *columns of distention* are planted on the *solid wall*; but it is necessary particularly to observe the attachment of the *anterior column* distinctly above the thin *moderator band**.

Now, in some other animals the *moderator band* is still less in size, and still more remote; until, perhaps, it altogether disappears†. But, on the other hand, tracing the series in the opposite direction, we see the *moderator band* rising to be inserted into the base (as at *F*), and even above the base of the *anterior column of distention* (as at *f*).‡

And, still farther on in the succession of gradations, the *moderator band* (or rather cord) has an insertion low down into the body of the *column*, and subsequently into the *solid wall*§: at the same time, we may perceive that the *column* is much increased in extent, which must give it a material influence over the *curtain of distention*, during its contraction.

In classing the animals after their several proportions of safety-valve construction, the following is the order in which I should arrange this first series; including only the animals whose hearts I have been able to examine at least once, and for the most part oftener||.

In the rat, the *columns of distention* are three or four; and the *moderator band* is a mere film, and very remote.

In the rabbit, the parts are the same; but perhaps the rudimentary *band* is proportionally somewhat more distinct.

Next in order is the hare, as already described.

Then follow together the kangaroo, the little bush kan-

* See Fig. 1. Pl. 2; and Diagr. 3. Pl. 2.

† See Diagr. 2. Pl. 2. ‡ See Diagr. 4. Pl. 2. § See Diagr. 5. Pl. 2.

|| Specimens of almost all the instances adduced will be found, either in the Collection of the Zoological Society, or in that of Guy's Hospital. A little series is also in progress of preparation for the College of Surgeons, at the request of Professor Owen, the distinguished Curator of the Hunterian Museum.

garoo, and the opossum*, all of which have apparently three *columns of distention*; and of these, the anterior has an increased relative size, at least in the two first animals. Their *moderator band* is a cord inserted into the very base of the *column*, and is double at its external attachment.

The bear has a construction like the preceding: its *columns* are three or four, and the *anterior* is larger. The *moderator band* is a slight cord, divided externally, but inserted into the column immediately above its base†.

The dog's heart is very little in advance of the last in the scale; and that of the fox is probably even less so. In an Australian dog, I found the *anterior column* divided at its base into two equal insertions; one of which was on the *yielding wall*, and was peculiarly remarkable for the traction which had manifestly been exerted upon it by an old and partial pericarditic adhesion‡ at this point. In another dog§, the second *column* was found bifurcated, and attached in a similar manner. Both these circumstances are probably very unusual||.

The squirrel and Guinea-pig plainly belong to this series; but it is not easy to determine their place. Likewise the porcupine; but in this case, the two chief *columns of distention*, or the first only, may be met with in a degree of evolution almost equal to that of the succeeding series.

The mole, the stoat, and the ichneumon, seem to form the last of this series, closely approaching those of the next, in the structures under investigation. In their hearts, the *anterior column of distention* is long, extending to near the limits of the cavity. The *moderator band* (a cord only) is attached to its body and both walls of the ventricle¶: the second *column* seems advancing towards a similar development.

Of these, the ichneumon appears to possess the more developed columns. The hedgehog much resembles these, with respect to the structure in question.

* *Didelphis Vulpina*.

† See Diagram 4. Pl. 2. f.

‡ A patch of pericarditic thickening on this spot is found in a majority of human adult hearts: it seems to be a part peculiarly liable to distention and attrition.

§ A Spaniel.—Two greyhounds (male and female) presented hearts peculiar only for great massiveness.

|| In both of these, experiment shewed the valve to act very imperfectly: in the first, some days after death; and in the second, whilst still alive.

¶ See Diagram 5. Pl. 2.

With regard to these, and all the succeeding series, I may observe, that many gradations must remain to be supplied; and the whole will require correcting, as well as enlarging. Possibly a long period of confinement, and limited diet, may affect the development or appearance of the columns.

In experimenting upon the hearts of this series, as well immediately after death as at later periods, I have, for the most part, made use of the largest animals that could easily be obtained; and I have not been inattentive to observe and vary their state of repletion, and also the general muscular efforts.

Upon making the injections, as formerly described, the result has been very various: and although the valve has often been seen to close neatly, and indeed firmly*, yet the quantity of reflux which has been noticed in some other cases has been rather a matter of astonishment. It has, however, never amounted to the copious regurgitation which I shall have to describe hereafter.

SECOND SERIES.—In the hearts of a second series of animals, the *anterior column* of distention is of full size, reaching to the extremity of the *yielding wall*; and the *moderator band* is considerably developed, particularly in the most-advanced grades; and in some we see, moreover, the *second column* of distention following the same course of development. (See *Diagr. 6. Pl. 2.*)

The appearance of a *moderator band*, in relation with this *second column*, rarely seems to become very significant, or deserving of attention†. A third *column* is usually found, but it is of small size: thus the curtains are more liable to displacement, by reason of the extent of the *columns*, and

* Blumenbach observes, that sometimes the right heart ceases to beat before the left, particularly in rabbits. This I conclude is the effect of the ventricle's attempt to contract, when full, and unable to expel its contents in either direction. The existence of some degree of reflux with the distention is the only cause I could assign for the longer continuance of motion in the right heart. I have found it easy to stimulate the left ventricle, when dying; and to renew its motions, by distending it with fluid.

† In ruminant animals, the *moderator band* having attained a great development, will be seen to decline through several degrees, as if less and less needful to the great *column* of distention which these animals possess. The same process probably occurs with regard to the liberation of the *second column* of distention, wherever it exists. Its *moderator band*, never very prominent, is less and less required, and fades away altogether.

their insertion occasionally into the *yielding wall*, together with their increased freedom from the *solid wall*, and augmented subjection to the movements of the *yielding wall*, through their connection with the *moderator band*. All this is superadded to the actual imperfection of the valve, or the yielding nature of its opening*.

The feline animals seem to be the first in this series. The cat has one considerable *column of distention*, based near the *yielding wall*, and traversed by the *moderator band*, which adheres to it, and confines it within a short range of the *solid wall*†. In the same animal, I have seen the *second column* also inclining to this disposition. The valve of the gennet cat strictly resembles that of our domestic animal. In the yaguarundi, the anterior *column* is perhaps still more confined. The burrowing marsupial wombat seems to be analogous to these last, rather than to the kangaroos, as relates to its safety-valve.

The ocelot offers one increased degree of enlargement of the *moderator band*, and freedom of the *anterior column*, without any other visible alteration.

The leopard has the *anterior column* still more free; and the *second column* is lengthened, and a good deal more free than the corresponding pillar in the preceding animals, as if loosening itself from the *solid wall*. (See columns 1 and 2. Diagr. 6. Pl. 2.)

The lemur‡ probably belongs to this series: its *first column* has, however, less freedom even than that of the cat, the *moderator band* being, externally, very slight; but the *second column* is considerable, and seems almost exclusively to belong to the *yielding wall*.

EXPERIMENTS.

A nearly full-grown cat, having expired two days previously in convulsions, without any assignable cause, its heart was found apparently healthy: the right side was not full, but less contracted than the left. On injecting this heart from the aorta and pulmonary artery, the mitral valve closed firmly; and the tricuspid admitted a very free reflux stream, without any force.

* See column 2. Diagram 1. Pl. 2; and Fig. 2. Pl. 2.

† As column 2. Diagram 1. Pl. 2.

‡ The individual was not known.

On removing a large and vigorous cat's heart as quickly as possible after pithing the animal, warm water was injected, or rather poured by the arteries into the ventricles, in succession, with a pressure of a column not exceeding four or five inches in height. The effect was the same as in the preceding trial, except that the regurgitation on the right side was still greater. This experiment was repeated subsequently, with the same results, but with the additional trial of the triple valve, during the progress of the tonic contraction of the heart, at intervals; and it was shewn, that not until the rigidity was nearly complete did the curtains close with precision.

A rather small and young cat had been without food for twenty-four hours, when it was pithed, and the heart immediately exposed. It was found beating, but unusually empty. On removing it, the right ventricle was injected with warm water to a considerable degree of fullness, and the valve was seen to close with much nicety, but gave a distinct jet of reflux with the systole; and there were three of these in succession, without any renewal of the contents by injection. The third was very slight, and the contractions were continued very faintly, without reflux.

All these experiments, as well as those on the human heart, might admit of minuter detail; but it is impossible, even for one accustomed to physiological experiment, to form an adequate idea of the play of these delicate valves, without witnessing it. Every endeavour in varying the degrees of force, or rather gentleness, and position, serves to prove the nicety of arrangement, and its liability to disturbance.

I have been compelled to omit, amongst other accounts, those frequent instances in which the hearts of these two first series were found possessing a nicely closing tricuspid.

THIRD SERIES.—In pursuing these gradations of valvular development from the one last named, that of the lemur, we should perhaps rank next all the genera of *Quadrupedia*; but the varieties which their tricuspid valves present are too considerable to admit of decided arrangement in this place. Some may probably require to be classed amidst the preceding series; and others may claim a place (according

to the amount of their safety-valve action) even beyond that of the human; which, for the present, is placed immediately after them, Man and the Quadrumana forming a distinct third series*.

After studying the structure in many quadrumana, I find it impossible at present to distinguish, in a satisfactory manner, the differences which it assumes in them. The thickness and capacity of their right ventricle differ much. The *moderator band* is visibly and progressively coming forward. The *columns of distention* are about three in number; but the two anterior of them only are considerable, and more or less inclined to the *yielding wall*. The variations† which the *columns* present in different genera, and perhaps even in different species, with regard to length, size, and freedom from the solid wall, form a little set of transitions of considerable interest for future inquiry.

The parts in the orang satyrus‡ may serve, perhaps, as a specimen of the medium characteristics of the valve in these varied tribes of animals.

The tricuspid valve of the chimpanzee is rather more like the structure in man; and, if we may judge from the extent of its *anterior column of distention* and *moderator band*, it will be found to possess a degree of safety-valve action exceeding that of the human heart.

Both these simiæ have their right ventricles capacious and thin; but that of the last appears strong.

The next gradation, in an advancing series, would probably be occupied by the human valve; the account of which has been already given§: but to decide on the precise place which each species of animals may claim, will require a very lengthened experience; and, moreover, there often appear to be other intentions or objects to be answered in the arrangement of the tricuspid curtains; as, for instance, whilst one animal may possess a greater extent of safety-

* As represented by the column 3. Diagram 1. Pl. 2.

† It has been explained that the human valves differ somewhat; and the same occurs in different individuals of any species, which much increases the difficulty of constructing a scale.

‡ Simia 8.

§ For the simplest form of the human valve, I refer to the little typical specimen, represented Fig. 1. Pl. 1; which may also answer, though not strictly, for the formation in the chimpanzee.

valve function, I strongly presume, that, in others, as in man, there will be found a much more delicately-acting valve—one more susceptible of displacement, though incapable of admitting the greatest degrees of reflux.

At this point, I am again desirous to call attention to the fact, which I formerly more fully exposed, that the human heart, subsequent to birth, follows the gradations hitherto described. The gradual wasting (so to speak) and dilatation of the right ventricle slowly withdraw the *columns of distention* from the vicinity of the *solid wall*. These gradations are also habitually imitated in the varying physiological conditions of distention or contraction: the expansion may even exceed the natural state, when the still greater degrees of reflux carry on the analogy between this—a state of disease—and the natural condition of those animals which follow in the scale of this function.

FOURTH SERIES*.—A fourth series of animals is found, in which a valve of a truly tricuspid form is commonly seen; and in which, for the most part, one large *column of distention* is implanted into the outer wall, and generally with a long and free *moderator band*. But all these parts, in the fourth series, are subject to considerable progressive changes. The *curtains*, which, in their simplest form, begin to resemble the crescents of birds, may, on the one hand, shew a tendency to the bicuspid form; or, on the other, the number of divisions may be found increasing.

The *column of distention* may be of good length, or short; and in the extreme case, the *corde of distention*, from 6 to 12 in number, appear actually to have insertion into the *yielding wall* (being as it were sessile). In this case, the *curtains* are uncontrolled by any proper muscle. It is not, I think, to be supposed, that here the *columns of distention* (as such) are diminishing in number or importance, but rather the contrary; for the single column is more properly the union of a number varying between two and six or seven; and this union cannot interfere with the direct outward traction of each one, since the column† is now become

* See column 4. in Diagram 1. Pl. 2; and Fig. 3. Pl. 2.

† Where it is developed. See Fig. 3. Pl. 2.

a little wall, parallel to the inner face of the *yielding wall*, and having the *cords* inserted into its upper edge. This edge consists of a little chain of nipples—the disunited summits of two or more columns, each drawing outwards in nearly an equal degree.

The most remarkable form of a *moderator band* is that in which this part is inserted close before the base of the *compound column of distention*; the opposite attachment being beneath the most anterior of the *fixed cords* on the *solid wall*. In this case, the *band* is muscular and cylindrical, but long and slight. It is very yielding, and seems to possess a peculiar elasticity. It is already declining in efficiency. It is evident that it can least control the more posterior parts of the column of distention. In the transition through which the band may be traced in this series of animals, it either gradually wastes, or slowly removes itself; and becomes more short and muscular, till it is nearly lost in the anterior and inferior junction of the two walls*. Now here, where the simple effect of distention is greatest, the *moderator band* is ceasing to have any distinct office; and thus we found it circumstanced in the first gradations, where the *columns of distention* were immoveable, and the *moderator band* a mere thread.

I have taken the parts in the sheep and goat as typical of the present series. See Fig. 3. Pl. 2.

The column of distention has, perhaps, a greater proportional development, as to width, in the first; the *cords*, as well as the original number of *pillars* (now united), being increased; and also, as I presume, the liability to valvular displacement. The gazelle resembles the goat; but its *moderator band* is manifestly leaving the *column of distention*. With it are the harnessed antelope and axis-deer, according to my specimens. The rein-deer possesses the compound *column of distention* in the greatest development, in breadth as well as in the number of cords and muscular points or nipples; but its moderator band has its insertion still more inferiorly than in the gazelle.

The ox has for a *column of distention* a short kind of mastoid process, over which the cords have scattered

* In describing the relative position of parts, I have generally regarded their analogy to the human structures.

insertions; and both the horse and ass* possess a little prominent *column*†. In all these, the *moderator band* is placed low, and very much as in the gazelle; and it is, for the most part, scarcely muscular, but long, slight, and yielding; and often almost disappearing, as it were by atrophy. Sometimes there are two thread-like cords only. On occasions, however, the *band* might appear to be of importance, being of great thickness and moderate length; but then it is placed farther distant from the *column*; and, as I have found it attended with an unusual degree of hypertrophy in the cavity, and elongation of the column, I regard it as a part of a congenital excess of power in this cavity altogether. Under all circumstances, it appears only as an exception‡.

The valve of the pig much resembles that of the sheep; but the cords and points in the *compound column of distention*, as well as the *moderator band*, are somewhat less considerable. The cavity seems capable of much enlargement.

The lama and camel present very interesting gradations. The first has a bifid *column of distention*, with pretty numerous *cords*; which seems to explain the opinion, that the broad column is formed by the aggregation of several parallel pillars; as if a succession of single columns left the *solid wall*, posteriorly, to augment the breadth and traction of the *compound column* in several different degrees or gradations. Here, and in many of these animals, the most posterior of the *fixed cords* are beginning to have a distinct muscular column. In the lama, also, the *moderator band* is muscular, and of good size, but very unfavourably placed to affect the *column of distention*: it is very near to the

* I found the proportion very similar in two zebra's hearts likewise.

† In the heart of one of the asses that were examined, the tricuspid seemed to have rather an unusual formation. The ordinary *column of distention* was of moderate size, and its *moderator band* was narrow and shortish. There was a second, and still considerable *column of distention*, pretty close behind the first. The most posterior of the fixed cords were, as usual, planted upon a considerable column. This was in an animal about six months old, which was killed with doses of prussic acid. About twenty minutes after its death, the tricuspid did not admit of reflux.

‡ The excessive development of the *moderator band* has been noticed in the horse, by Sir Astley Cooper. I have seen it but once. Once, also, in the diseased heart of a woman, I met with it.

anterior union of the two walls. In the length of its *column*, and the remoteness of its *moderator band*, the camel would appear to stand about midway between the rein-deer and the lama; at least, if I may judge from a single, and not a very favourable specimen*.

According to its valvular formation, the seal requires a place among the fourth series of the Mammalia. It has a *moderator band* of rather less efficiency than that of the lama, but its compound *column of distention* may be said to be triple. It is large, irregular, much divided, furnished with many cords, short, and based upon a thin and cellular wall. The posterior *fixed cords* possess a considerably muscular column. The cavity admits of much extension. This animal has some slight tendency to a division of the ventricles in the form of a bifid apex; and seems to be allied by this, as well as by its habits, to those warm-blooded and respiring aquatic animals, in whom the separation of the ventricles is more distinct, as in the porpoise, and still more in certain other cetacea. Now we may fairly infer, that the object of a bifid heart, in these animals which remain long under water, is one of some importance (See Fig. 4. Pl. 2. and Diagr. 7). The following are some of the facts, in connection with the arrangement which is peculiar to them. The usual *apparatus of distention*, and the *yielding wall*, are constructed after a plan which has been formerly described in the account of the third series. A great extent of the wall being thin and spongy, the common *columns of distention* are very similar, in number, site, and force, to those of the human heart: probably, however, the facility and extent of displacement are greater in the present case. We have now to add, that the *yielding wall* is prolonged to the point of bifurcation, and includes the apex of the ventricle;—that the *solid wall*, as it has hitherto been called, with respect to the right ventricle, is here becoming, or giving place to, a thin and *yielding wall*. Moreover, the inner (left) portion of the

* The right ventricle of the giraffe possesses a valve of a very simple tricuspid form. The single *column of distention* is of little width, conical, and somewhat lengthened. Its cords seem few, and little scattered on the summit. The *moderator band*, long, and of inconsiderable thickness, is placed nearer the single column than in the lama and camel. One posterior fixed column is considerable.

tricuspid valve, formerly spoken of as *fixed*, is becoming liable to the effects of distention; for its muscular columns, now increased in extent and power, cease to be attached, near the base of the heart, into the *solid wall*, and are continued, beyond the division of the ventricles, into the apex; that is, into the thin, separated, and more yielding part of the ventricular paries. These may be called *accessory columns of distention*, both from their muscularity and connection. The seal affords only the early traces of this conformation; but in the porpoise the gradation is considerably advanced: so that whatever value may be allowed for the terms here employed, or for the explanations adduced, such is indisputably the progressive development of the anatomical character of these parts, throughout the class Mammalia.

I have had no opportunity of examining more divided hearts than that of the porpoise; but I cannot doubt that their structure follows the plan here indicated by the train of analogies. (See Diagr. 7. Pl. 2. and the description.)

The experimental test on which I desire to repose the whole truth of these opinions is, the comparison, by injection, of the right valves in animals of different grades; as, the dog and sheep, before the pulsations have ceased.

The great and manifest imperfection of the sheep's valve, which will every now and then be found, must be convincing.

Having concluded that the reflux function is greatest in the last, or fourth series of animals, it may justly be expected that the experimental proofs shall here be the more satisfactory*. And here, also, we shall find the most marked appearances in the general animal frame, which serve to corroborate the view of temporary venous delay and accumulation; as might indeed be anticipated from casual traces displayed in animals included in the earlier series, as well as

* During the autumn of 1835, on producing a series of these preparations, both human and comparative, before M. H. Cloquet, illustrating the view of a reflux action under distention, I had the gratification of gaining a very satisfactory assent to these opinions from that distinguished anatomist. In order to carry conviction, it seemed enough to set together the three facts, that the valve is naturally imperfect or feeble, that the ventricle is liable to distention, and that the valve of distention is manifestly dependent on the situation of the outer wall.

in the grades which remain to be successively considered of the class Aves. I can only allude to the progressive development of a dilatable pulmonary artery up to this series, and also of venous reservoirs: amongst the last, I rank the innumerable superficial veins of the horse; the elastic reticular spleen of herbivorous animals; the multitude of tortuous internal veins of the divers, with the sinuses around the spine and the cell in the liver, which is sometimes larger than the entire heart*.

EXPERIMENTS.

A sheep was stuck in the usual manner; and, fifteen minutes after, its heart was removed, having scarcely ceased to palpitate. The substance was loose, and the cavity wide. On injecting by the pulmonary artery, the curtains approached each other in a plane; but were very much separated, leaving an aperture nearly equal in extent to the disc of a shilling.

The *moderator band* was about sixteen lines in length, and capable of much greater extension.

The heart, at the end of an hour, had so contracted, that its tricuspid valve, when the ventricle was filled, closed neatly, and only admitted three or four thready jets. I infer that some accumulation in the act of dying had distended the cavity.

In another animal, twenty-five minutes after it had been stuck, the heart was more than half contracted, and very firm†. Upon injecting, the curtains closed, and formed a

* These last statements are supported by Preparations now placed in the Collection of Guy's Hospital. The accounts that have been given of the veins of diving animals seem only to require the idea of an arrested pulmonary circulation to explain the intention of these reservoirs.—See a Paper on the *Peculiarities of the Circulating Organs in Diving Animals*, by Dr. Houston; read before the Medical Section of the British Association in Dublin (1835). With reference to the venous system only, the Doctor seems to prove, that the right ventricle fails to propel its blood: and the inference which we may safely make, is, that it either contracts on a reflux stream, or it does not contract at all.

Not only do we find passive venous reservoirs for delay, but also copious contractile arterial reservoirs, both for general and local supplies of blood during the delay in the lungs. The Museum of Guy's also affords specimens of these.

† It happens very constantly, in opening living animals in all respects healthy, that the firmness of the heart is found to vary greatly, as well as the time at which it assumes its tonic contraction.

valve of considerable strength, with but one slight columnar jet*.

A goat, fattened for slaughter, was struck three smart blows on the head, and the chest laid open in about three minutes; the respirations having scarcely ceased. The heart distended the pericardium, and was beating feebly. It was immediately cut out. Its substance was loose, and the right ventricle very wide. The long pipe of a syringe was inserted at once into the pulmonary artery; but the tricuspid curtains at this time were not equal to closing more than one half of their aperture: the bicuspid acted perfectly. Cold water was injected. At the end of twenty minutes, the right valve was but a little more perfect: after ten minutes more, its closure only transmitted two very broad bands of reflux†.

The heart of a pig has only been experimented on in a state of semi-contraction, as it seemed; and in this case, the right valve acted with tolerable precision.

A male gazelle had been dead three or four days. The heart was very full of fibrinous blood. Under injection, the

* I have several times performed parallel experiments to these last, on the hearts of sheep, at different periods after their last pulsations; and the consequences have always been very similar. The probability is, that the tricuspid valve in sheep has an exceedingly incomplete function as a valve; since, in the yet living heart, the simple pouring in of water by the pulmonary artery is sometimes attended by a complete reflux, although the curtains easily flow to with the current; and although it is always seen, when the ventricle has had time and freedom to contract, that the valve acts nicely, and with some strength.

† I have attained the same result often, and the contrary also. A kid, seven weeks old, was allowed to feed during the day, until four in the afternoon, when it was killed by one stroke on the head: the chest was ripped open, and the blood escaped by the cava: the heart was immediately cut out, and the pipe of the syringe held in the mouth of the pulmonary artery. The right ventricle was thin, and held a large quantity (of cold water): it still continued to contract feebly: a little force served to bring the valves imperfectly together; and they closed pretty neatly, but very feebly. After about twenty minutes, there was but little improvement.

In another kid, about eight weeks old, insensibility was induced at a blow, and the heart removed almost instantly. The contractions of the right side continued imperfectly for two minutes during the injection: the valve closed very feebly; but though it allowed some escape, the ventricle was easily filled without force: a very little produced an increased reflux. It had eaten nothing for twelve hours, nor sucked for eight. These results depend on the removal of the heart without the accumulation which struggling or a gradual death are likely to produce.

pulmonary sigmoid valves acted but feebly, and the tricuspid closed almost accurately, although the right ventricle was rather large.

The heart of an antelope that had been dead several days appeared in good condition. Its right ventricle was firm and of good thickness, but somewhat in a state of fulness or distention. By injection, the three triangular folds formed a plane, with very wide fissures between them. This aperture closed somewhat with more forcible injection; but the escape was rapid, and the walls were too solid, in death, to yield*.

The *moderator band* was not very long.

A zebra died unexpectedly in the night. On the second morning, the heart appeared healthy, and in a medium state of fulness. The pulmonary valves acted well, and the tricuspid curtains closed with some nicety.

The heart of an ass was removed from the body at the time of death. When injected the following day, its tricuspid formed a wide unbroken plane (a very admirable adaptation). At the same time, on passing a finger through the closing valve (the injection being kept up forcibly all the while), the *moderator band* was felt, long and loose, and capable of admitting as much more fluid as the cavity contained. This cavity was of good size; and its wall, both firm and thick, was so consolidated by tonic contraction, as to form the greatest contrast with the living state, after a systole, or at the point of death.

The left ventricle and valve were very powerful.

On injecting the right ventricle of a cow some hours after the death of the animal, the valve appeared to act almost perfectly; the cavity being, as I supposed, in a state of contraction.

In a second experiment on the heart of a very large ox, about thirty minutes after the creature had been struck down, it was anticipated, from the solidity of the left ven-

* The extreme softness and laxity of the yielding wall of the right ventricle, in the interval of the systolic efforts, as well as immediately after the last distinct contraction, requires to be contrasted with the firmness which the wall subsequently attains in death, whether suffering under distention or not. When an animal dies, probably no congestion in the healthy heart is capable of preventing a certain degree of tonic contraction, even in the auricles, and much less in the right ventricle.

tricle and the limited extent of the right, that the valve of the latter would close well; but the first attempts produced a reflux, which, though considerable, was not great for the size of the organ. Waiting, however, about twenty minutes, and then renewing the distention, the valvular action had evidently become much more true. In these two hearts, the complete action of the left valve, and its great power, formed a marked contrast with the function of the tricuspid.

Half an ounce of strong tobacco was infused in a pint of water, and the liquid was injected into the jugular vein of a horse. The operation lasted about two minutes: he staggered for near a minute, and fell: his legs were partially secured; but he plunged violently for near ten minutes, breathing fully. Air was now let into both pleuræ; and in about sixteen minutes from the first, all respiratory efforts had ceased: some motion of the heart continued for about another minute. The right side was most prodigiously distended, and the left auricle was also full.

Two or three minutes were occupied in removing the heart; and affixing it, by the pulmonary artery, to a large water-cock, the column of water being eighteen inches high, and the diameter of the tube nearly equal to that of the pulmonary artery. Under this pressure, the cavity became full; and the contents escaped as rapidly, without the least disposition to distention. The heart was supported so as carefully to leave the right ventricle unpressed; but now, upon pressing in the situation of the *column of distention*, so as to carry it inwards, the *curtains* closed considerably, and the reflux, for so large an organ, was very moderate: at the same time, the ventricle became filled much more firmly. The left ventricle was already contracting permanently.

This heart had every appearance of perfect health.

Another horse, quite aged, that had eaten nothing for four hours, and but a very little hay for several hours previous, was destroyed with a smaller quantity of a stronger infusion*. Its struggles were very slight, and it ceased to breathe in about ten minutes. In about fourteen minutes, the heart was exposed; and found very greatly distended on the right side, and without motion. Several minutes elapsed before it could be removed and affixed to the same water-cock as

* Four ounces to three pints: about twelve ounces injected.

before, but with a column of fluid three feet in height. The events were the same as in the former case; excepting this, that, on pressing in the root of the column of distention, the valve acted more closely, and the cavity filled more tensely. Three days afterwards, this valve acted very truly.

An experiment was performed on the heart of a horse many hours after death; and in this, the massiveness of the whole warranted the conclusion, that, at least, it was partially contracted. The tricuspid acted the part of a pretty accurate and strong valve.

A young rein-deer, nearly full grown, was opened on the second day after death, and the heart removed. It seemed large, in comparison with the size of the animal; and its surface presented two or three little cysticerci, but it was otherwise quite healthy.

The right side was rather loose, and had probably been full. One pulmonary artery being secured, the other was used to receive the injection. The sigmoid valves would retain nothing*, and the tricuspid was still more imperfect. The valves were all healthy, and the left ventricle powerful.

At the conclusion of the investigation of this safety-valve function in the class Mammalia, it will hardly be necessary to observe, that the *simpler* action of the right ventricular valve is doubtless nearly perfect in all cases. On the contrary, I cannot suppose that many experiments will be required to prove, that, in most cases, a very natural and common state of distention may render the valve imperfect; that is, a *safety-valve*.

To establish, experimentally, that certain proportions of this function are dependent on the precise stages discoverable in the structures concerned, would be impossible; although such a conclusion will pretty naturally follow in the mind of all who shall once have witnessed the different appearances of the valve, under experiment, in two extreme points of the series. Thus, in a set of experiments on dogs, the valve will surely be found more or less perfect; and as surely, in a few varied experiments on sheep or goats, it will be found much less true, though in very different degrees.

* This occurrence is by no means very uncommon.

Fig 1.

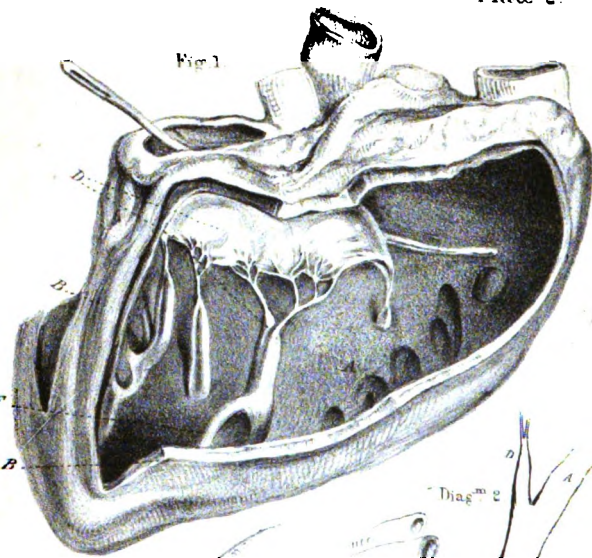


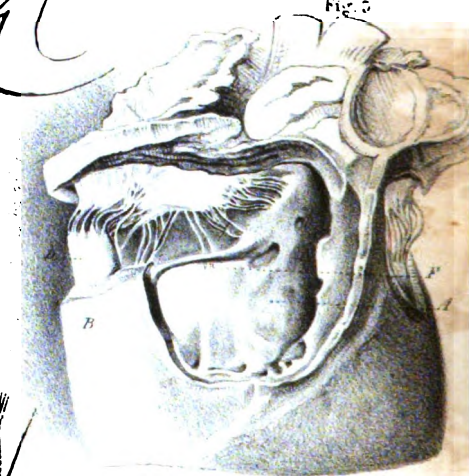
Fig 4.



Fig 2.



Fig 3.



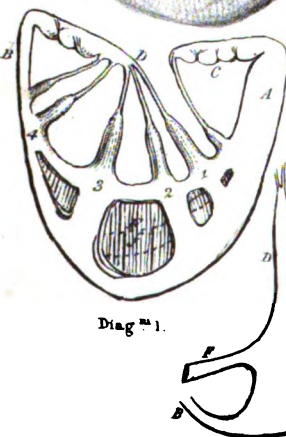
Diag^m 2.



Diag^m 6.



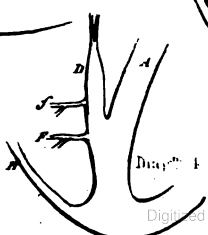
Diag^m 1.



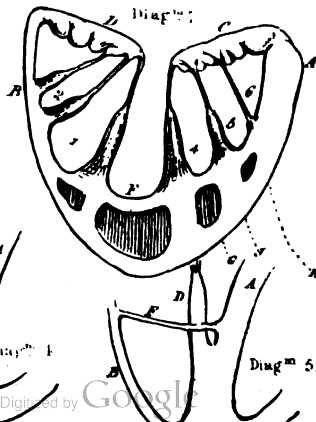
Diag^m 3.



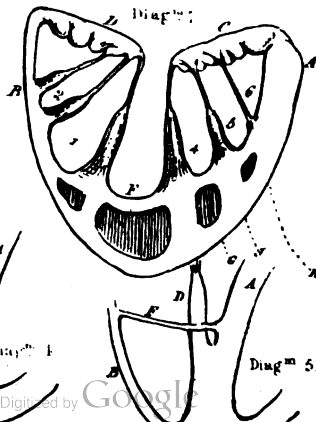
Diag^m 4.



Diag^m 5.



Diag^m 7.



DESCRIPTION OF PLATE II.

Fig. 1. represents the Right Ventricle of the Hare, laid open: the outer curtains (or those of *distention*) are fully displayed, with their *cords* and *columns* affixed to the *solid wall*, and consequently not subject to the movements of the *yielding wall*. The fulness of the cavity, however, may vary considerably; and the excess so far expand the auriculo-ventricular foramen, that the scanty curtains shall close it less completely. Thus the *curtains*, *cords*, and *columns*, here shewn, may still retain the name of *curtains* &c. of *distention*. At the base of the largest and foremost *column* of *distention* is seen a slight *moderator band*, reaching to the *yielding wall*: in this gradation, it is of very little importance, as to size, site, and use. The probe passes from the right auricle, through the tricuspid opening, into the ventricle, towards the pulmonary artery.

It should be observed, that the letters of this and the third Plate indicate precisely the same parts as those in the first.

Fig. 2. is a Drawing taken from the Right Ventricle of the Yaguarundi (a feline animal). The *curtain* of *distention* is seen, with its *cords* and *columns*; but the larger *column*, the *anterior*, only seems liable to a slight displacement. A limited portion of *moderator band* attaches it to the *solid wall*, whilst a slighter and longer part of the *band* connects it with the *yielding wall*. The first part allows whatever little motion the last part is able to effect, when the *yielding wall* suffers distention; and, in addition, the length of the *column* renders its proper contractions of importance; whilst its base, more or less connected with the *yielding wall* below, is proportionably less fixed.

Fig. 3. represents the Right Ventricle of a Goat.—Here is seen very prominently the *moderator band* stretching from the *solid* to the *yielding wall*: and where it joins the latter, the *column* (a compound one) of *distention* arises; and this is seen to afford attachment to a number of *cords*, and a wide extent of *curtain*.—The cavity is shewn rather in a state of contraction than distention. The observer will scarcely fail to be struck with the conclusion, that a *column* of this kind cannot but produce a very great displacement of the *curtains*, if it be really true that the cavity is susceptible of much distention. The sheep and some others certainly present a still broader or more compound *column*; but in all of these, experiments shew, that, with the least possible disturbance of the circulation in dying, the valve may become totally useless, but that a very few minutes restores its true action, by drawing in the *yielding wall*, and with it the apparatus of distention.

Fig. 4. is a Posterior View of the Right Ventricle in the Porpoise. Inferiorly, the bifurcation of the ventricles is seen, but here somewhat less than I have found it in a recent specimen. Within the cavity, the two shorter *columns* of *distention* (D and E) are represented, attached to the thin reticular *yielding wall*, above and externally. (C) indicates two longer *columns*, which, in the first gradations, we called *fixed*; but they are now become *accessory columns* of *distention*, being fully developed, and based rather on the *yielding* than the *solid wall*: each one, however, has a partial attachment to the *solid wall*, which is not here seen.

Diagram 1, like those of the preceding Plate, represents a Section of the Right Ventricle; and is intended to illustrate the gradual change of position incident to the *columns* of *distention* in a succession of animals.

- A The *solid wall*.
- B The *yielding wall*.
- C The *fixed curtain*, and its *cords* (one instead of many).
- D The *curtain*, and *cords of distention*.
- F The *moderator band* (of distention).
- f The transverse dotted lines explain the gradual disappearance (the fading transitions) of the same *band*.

The Numerals refer to the various attachments peculiar to the *columns of distention* in the several orders of animals.

In relation to the *moderator band*, the *columns of distention* (represented, in each case, as one) are attached internally towards the *solid wall*, as seen at 1; or they are attached externally towards the *yielding wall*, as shewn at 4; or their attachment is intermediate, as at 2 and 3, between the two walls and upon the *moderator band* itself, though also extending farther, to be attached to either wall.

Diagrams 2, 3, 4 and 5, may serve to portray the four earliest stages in which the *column of distention* is found, as described in the first series of animals.

In Diagram 2, the *column* (D) is small, most dependent on the *solid wall* (A); most remote from the *yielding wall* (B); and almost destitute of a *moderator band* (F). In the remaining three, there is seen a gradual increase of the column and band, and a greater inclination towards the yielding wall.

Diagram 6. represents a considerably greater development of the apparatus of distention than the preceding.

- D The *first column of distention* is becoming subject to the yielding wall; and
- E The *second* is following the same mode of evolution.

The dotted column is also developing itself.

Diagram 7, like those preceding, shews the formation of the apparatus of distention as connected with the *yielding wall* (B); the common *columns of distention* (1 and 2) being attached to it. And here is likewise represented the gradual development of the bifid heart, with thinning of the cavity's left wall towards the apex; and the corresponding gradation of the *columns* formerly fixed, now more properly the *left or accessory columns of distention* (4, 5, 6). If the dotted line (G) be the outline of the separated left ventricle, the great column (4) will justly represent the arrangement of this structure in the Porpoise; in whom the newly-developed *accessory column of distention*, partly confined by the *moderator band* (F), is based upon the thin and *yielding* part of the left wall, once the *solid septum*. To explain the adjustment of parts in the Seal, the same Diagram and References may serve, with the exclusion of the great column (4); in which case, the incipient *accessory column of distention* (5) is inserted into the *solid wall*, with many other *cords*, and unaffected by dilatation: but it is remarkable, that already the length of this muscular column renders its contraction an important object in the motions of the valve, as is also the case in some ruminants. The remaining dotted lines (J & K) are intended to represent the outline of the left ventricle, in the succeeding stages of more considerable separation; that is, in cases where the bifid heart is most marked. In these cases, so much more of the *solid wall* will be *yielding wall*; and so much more will the *fixed columns* become, as I anticipate, *accessory columns of distention*.

PART III.—OF THE SAFETY-VALVE IN BIRDS.

THE FORM, ANALOGY, AND GRADATIONS OF STRUCTURE, IN THE SAFETY-VALVE OF BIRDS.—THE FUNCTION ILLUSTRATED BY EXPERIMENTS.

It seems likely, that the small quantity of circulating fluids natural to birds, together with their elevated respiratory function, should demand a free and speedy pulmonary circulation; it is undeniable, that the crescentic valve in their right ventricles is admirably adapted to insure such an action; and I am deeply impressed with the conviction, that the most experienced zootomists will find the greatest difficulty in admitting the opinion I am about to maintain; yet I do not doubt that it will finally be found a correct and important deduction.

The modification of a safety-valve apparatus in the right ventricle of some birds has appeared to me strikingly peculiar, and not less manifest than in many animals, although the effect must be less considerable.

For the sake of description, I shall still have occasion to speak of the *septum ventriculorum* as the *solid wall*; and likewise to consider the thin outer or right boundary of the ventricle as the *yielding wall*. (See Pl. 3.)

In all birds, the right auriculo-ventricular opening is of a narrow, lengthened, oval figure; or rather, it is a fissure; and it is guarded, as is well known, by a crescentic plane of muscle, whose flat surfaces are apposed to the two walls of the ventricle in which it lies, and whose concave margin, acute and free, is presented towards the apex of the heart. The convex edge of this crescent is united to the auricular margin of the *yielding wall*; that margin being, as it were, folded into the ventricle, in order to form the *valvular crescent*, by which name it will be desirable to distinguish this part. (See D 2 of the Figs. on Pl. 3.)

The inferior horn of this *crescent* is attached to the *solid wall*, at the point where the two walls unite posteriorly; and the anterior and superior horn, being directed towards the pulmonary artery, has attachment to the inner face of the *yielding wall*; whence it is immediately

deflected, to be inserted into the *solid wall* at the anterior extremity of the auriculo-ventricular fissure. Now it must be evident, that when the *yielding wall* is affected by distention, this last deflected portion of the *crescent* will be proportionately elongated; and, at the same time, the adjoining extremity or horn of the *valvular crescent* will be removed, in an equal degree, from the *solid wall*, against which it ordinarily closes fast.

This is the explanation of an aperture of reflux—a safety-valve under distention—as existing in birds in various degrees; but probably not in all of them.

The anterior attachment of the *valvular crescent* varies, in its extent and strength, in the different orders of birds; and, at the same time, the deflected portion of the *crescent* is found to have different degrees of elongation, according to which the distention of the *yielding wall*, with the displacement of the *valvular crescent*, may be regulated, and, indeed, estimated.

In certain cases, the deflected portion of the *valvular crescent* is so extensive and important, so distinctly and fully crescentic (in itself), and so plainly adapted to the office here ascribed to it, that I shall speak of it as the *crescent of distention* in all birds; premising, that in some it is very inconsiderable, or possibly even altogether lost. (See D. 1. Fig. 2. Pl. 3.)

The *crescent of distention* is thin, and chiefly membranous, especially where most developed. It is in some respects analogous to the *moderator band* in the mammalia; but I rather regard it as a modification of an *anterior curtain* of the most simple tricuspid valve; and should look for the rudiment of a *moderator band* among those little pillars, which assist to connect the two walls opposite to the *crescent of distention* anteriorly. (See F, Fig. 1. Pl. 3.)

The formation of the *crescent of distention* is similar to that of the *valvular crescent*. We might suppose a small part of the auricular edge of the *yielding wall* folded into the ventricle, and having a free crescentic margin bounded by a little horn at either end. The left or posterior horn of this little *crescent* is inserted into the *solid wall*, near the pulmo-

nary artery. The anterior horn of the *crescent of distention* is attached to the *yielding wall*, in conjunction with the anterior horn of the true *valvular crescent*; thus forming an *attachment of distention*, which is strictly analogous to the single *column of distention* in certain quadrupeds, as in the horse; and more remarkably so, when it (the *attachment of distention*) is divided into several *cords*, as I have sometimes found it.

Considering the crescents in the distended ventricle, the auriculo-ventricular opening may be represented by a triangle (as in Diagrams Pl. 3.), the base of which is (A) the *solid wall* of the cavity; whilst, of its two other sides, the longer one is formed by (D 2) the *valvular crescent*, and the shorter by the *crescent of distention* (D 1). The union of these two, at their common point of attachment (D), forms an angle which seems to differ somewhat in different orders, and to be of some importance with respect to the function of reflux.

I shall endeavour to shew that the tendency to distention in the right ventricle of birds exists in various degrees; that it is gradational; and that the extent of the *crescent of distention* is of correspondent development in the several gradations; and that the consequence of this is, that the *valvular crescent* is liable to displacement in the same proportion, to the effect of producing regurgitation. In one case, the susceptibility to dilatation is very insignificant: the *crescent of distention* is short, and the *valvular crescent* cannot be removed from the sphere of its true valvular action: the fissure is open only to the afflux of blood. In other cases, the dilatability of the ventricle is more or less considerable, or it is extreme: the *crescent of distention* is elongated accordingly; and the *valvular crescent* is proportionately displaced, whenever the cavity becomes distended. In the same manner and degree, the auriculo-ventricular opening continues unclosed during the distention; and the aperture of reflux is free.

It is apparent that the thickness or thinness of the *yielding wall* forms a very essential consideration, with regard to its liability to distention; and it is observable, that, as in

the mammalia, so in birds, the power of this part varies very much in the different families. The thickness of the *yielding wall* of the right ventricle, compared with the parietes of the left ventricle, may be as 1 to 2 or 3, or as 1 to 6 or 7*.

The *attachment of distention*, or the united attachment of the two crescents to the *yielding wall*, varies in its breadth, and also in its length †, in the several families: sometimes it is a double cord, or triple, or even more. In the same manner, the angle formed by the two crescents differs, in different cases, between a right angle and one of considerable obtuseness. It has usually been said, that the *solid wall* in birds is convex, and that the *valvular crescent* is curved upon it; but this statement is chiefly applicable in those cases where the valve is least susceptible of displacement by dilatation; for the *solid wall*, at least that part on which the valve lies, may be flat, or actually concave. All these circumstances are readily demonstrable; but the estimation of their extent and influence must remain for further elucidation.

We may now see that the strict closure, or imperfect action of the crescentic valves, throughout the class Aves, will depend on the variations which subsist in the relative proportions of the cavity, and of the *yielding wall* of the two *crescents*, and of the *attachment of distention*; and that the prominent or receding form of the *solid wall* will also play its part in regulating the operations of the valve ‡.

Having examined the elements of a safety-valve in the birds, and explained the circumstances of its variation, we

* Indeed, the comparison of the walls of the two cavities affords a much more remarkable contrast in certain birds than in any of the mammalia. In the Stanley crane, I found the thickness of the right ventricle less than one-sixth that of the left; and in the black diver, certainly less than one-fourth.

† Its length, reaching more or less towards the centre of the *yielding wall*, is a very important point, as relates to the *delicacy* of the safety-valve operation.

‡ The intention of the crescentic and muscular valve was supposed, by Blumenbach, to relate to the exalted respiratory function, or rather to a powerful pulmonary circulation, in birds. But this will scarcely suffice to explain

have next to inquire, what proofs may be produced of an actual reflux action. These are very similar to those which relate to the mammalia. It must also be a desideratum, to determine those degrees of this function which belong to each particular genus or individual of the class. The anatomical history of a few particular species will serve amply to establish a series of structural gradations; but with resources of the utmost extent, a long period would be required to settle the scale of this function in its full extent; and the task would be the more difficult, on account of a certain complexity which is discoverable in tracing it, or the structures on which it depends. I have imagined, that, in the genera of one order of birds, the safety-valve is produced in widely different proportions, as in the Palmipedes, and again in others also; so that the limits of one series on the scale may surpass those of the adjoining ones, in either direction.

The preparations which I have collected will satisfactorily prove thus much, and probably more; but though very numerous, they are quite inadequate for the purpose of determining the distinct and successive gradations.

In the black diver, I have found all the essential parts of a safety-valve, in their complete development; the thin and extensive *yielding wall*; the long membranous *crescent of distention*; the angle of the two crescents almost acute; a tolerably flattened *solid wall*; and the *attachment of distention* rather long, narrow, and inclining towards the middle of the *yielding wall**.

Now, throughout the order Palmipedes there is an evident

explain the economy of the divers, and surely not that of the crocodile, which possesses an analogous valve. I rather conclude, that the peculiar valve of the birds—a mere modification of a true tricuspid—may be calculated for a circulation in which, the quantity of fluid being small, a more precise valvular action is required, together with a more limited, but not less sensible or delicate safety-valve.

* Some of these Palmates possess venous reservoirs, which are scarcely less remarkable than those of the Cetacea. The veins of the mesentery are very large and numerous. In the present instance, one jugular vein is as large as the little finger, as it is preserved, *injected*. The large elastic and vein-like pulmonary artery is also notable.

succession of forms in which these characters are modified*. The Grebes possess them in a decidedly less marked degree.

The valve of the cormorant may be probably less close than that of the Grebes: the breadth of its *attachment of distention* links it in resemblance with others of which the swan has seemed (hitherto) to afford the most remarkable type. These, with a moderately powerful and capacious ventricle, have the two crescents united almost at an obtuse angle, or, as they might be described, forming nearly a continuous crescentic line, in opposition to a *solid wall* of some convexity. The broad *attachment of distention* which in the goose and cormorant may be found divided into three or four cords is a pretty manifest means of displacement and reflux, which, I imagine, must be very considerable in these birds.

I am tempted to remark here, that, among the varieties of birds, the general properties of the crescentic valves, but especially of the *attachment of distention*, are considerably modified, and in a manner which does not merely depend on or affect the strength of the valve. This has enforced upon me the opinion suggested when describing the safety-valve of the mammalia; namely, that we may trace at one time a safety-valve that is very susceptible of acting; and at another, one less delicate, but more extensive in its function.

In the Grallatoriae, it would seem likely, that, with a considerable share of the elements of a safety-valve, material differences may exist with regard to the proportions possessed by particular genera, and even different species. In determining these, sources of fallacy and difficulty must intrude themselves, and in a very discouraging manner; as, for example, the parts in one instance will be found contracted, diminished in extent, thick and firm; or they may be in exactly an opposite condition. Notwithstanding this, a careful examination will assist to establish certain prominent features of distinction. The formation of the valve in the Stanley crane, as I have met with it, might alone convince

* Not more modified, however, than are the habits of the species as relates to diet, flight, swimming, &c.; and a like reflection should be connected with other orders.

many persons* of the existence of a safety-valve function. The concave *solid wall*, the wide and attenuated *yielding wall*, the delicate and extended *crescent of distention*, with a rather large *attachment of distention* reaching to near the middle of the *yielding wall*, all concurring, render it almost doubtful that a true valve was ever intended.

The same parts in the heron have certainly less susceptibility to dilatation and reflux; and in the caracara likewise, if we may judge from the appearance of the valve: but in this last, the ventricle, being full, is scarcely thicker than the auricle.

The ostriches have a broad *attachment of distention*, with a somewhat limited *crescent of distention*. The examination of parts of this magnitude, in their uncontracted state, makes the view of a reflux action highly probable. I speak after having seen at least six or seven different specimens. Nothing can be more true and powerful than the valve in the contracted ventricle.

Beyond the Anseres and Grallæ, we meet with a visible declination of the parts which belong to the function of reflux.

Many of the Gallinacæ, Scansores, and Passerinæ, are possessed of very confined valves and ventricles. But whilst studying the negative properties of these, as available, by comparison, to corroborate the inferences from a looser arrangement, we may discover, in some divisions of these orders, a growing tendency towards the proper characters of a safety-valve†.

The structure in the pigeon has sometimes had the appearance of being thus inclined; but more particularly that in the crow and raven; in which last case, experiment is favourable to the same conclusion.

The *crescent of distention* in many of the Gallinæ is greatly diminished; but I had not been prepared for its absence

* Perhaps no one would demur, who had once seen the living right ventricle of a bird in the two states of distention and relaxation.

† It is very evident, amongst these birds, that a gradual change may be traced in the comparative extent of the *crescent of distention*, and also in the length and width of the *attachment of distention*. Of course, the insertion of this last will vary according to its length.

in any, when in the silver pheasant* the anterior attachment of the *valvular crescent* appeared distinctly to cease at the *yielding wall*, in close proximity, however, with the *solid wall*. The usual perforation or canal, above the attachment of distention, would only admit a bristle.

The common pheasant, having a very insignificant *crescent of distention*, evidently approaches this formation: thus the valve is becoming gradually more simple.

The conformation of the crescentic valves in various genera of the Accipitres, if admitting any reflux, is certainly opposed to any considerable degrees of the function†. The whole heart seems compact and powerful. The *crescent of distention* forms nearly a continuous line with the *valvular crescent*. The first, however, is of good length. The *attachment of distention* is peculiar, in being slight, and somewhat lengthened. Its point of connection to the *yielding wall* is not unfavourable to the production of a slight displacement; and it probably exerts a degree of disturbing influence in certain species. In others, its effect must be little or nothing: indeed, I could anticipate its total obliteration, having already found it faded to a thread. Here

* Of China. I have examined but one.

† The resemblances between certain families of birds and quadrupeds are pretty clearly discoverable in the gradation of the safety-valve peculiar to each. It was while studying the part in the rapacious birds that this first struck me. The analogy, however, is most remarkable in the divers of the two classes.

M^rLeay has arranged five divisions of the Mammalia and of the Birds, in apposition to each other, according to the analogies discoverable between a certain division in the first class and one in the second. In this arrangement (as below), I have little hesitation in appending to each two, analogous divisions, a particular degree of safety-valve operation:

| Degree. | Mammalia. | Birds. | Habit. |
|-----------|-----------|---------------|-----------------------------------|
| 1st . . . | Glires | ... Rasores | ... Frugivorous. [pletion.] |
| 2d . . . | Feræ | ... Raptores | ... Carnivorous; (indolent in re- |
| 3d . . . | Primates | ... Insesores | ... Omnivorous. |
| 4th . . . | Ungulata | ... Grallæ | ... Frequenting watery places. |
| 5th . . . | Cetacea | ... Natatores | ... Aquatic. |

With regard to the degrees 1, 4, and 5, I am disposed to entertain very little doubt.

The present occasion will not allow me to do more than advert to the probable explanation of these differences. It seems to me, that the various habits of individuals, as to feeding and drinking, and the modes of exercise and respiration, may perhaps be sufficient to account for all of them.

we seem to observe one, more element of the valvular apparatus fading away.

The relation of a few experiments on the valve of birds will serve to draw these views to a close. These have not been less conclusive, in my opinion; but, in order to meet the settled conviction which prevails as to the office of the crescentic valves, and with a view to obviate objections that will arise to the experimentalist, it is necessary to take some notice of the condition of the parts to be experimented upon.

The right ventricle of birds doubtless may, and often does, become distended in dying; yet we mostly find that the subsequent tonic contraction lessens the distention, and adjusts the valve. The most common condition that we find, at any time within a fortnight after death, is certainly one of contraction, though variable as to degree. The same obtains, apparently, when the death has been attended with loss of blood, and when it has not. The suddenness with which the heart of birds may contract permanently, when removed alive, is very remarkable, and must not be forgotten.

When experimenting formerly on birds, I found the right valve so generally and firmly closed, that if very conspicuous differences in the valvular construction had not presented themselves, I should have resigned all idea of a safety-valve in this varied class of animals. In numerous trials upon several kinds of poultry, at different and, for the most part, distant periods after death, the valves acted very well, with scarcely any exception; or, at least, the inference of a safety-valve function was by no means satisfactory.

Probably very few persons have had the opportunity of noticing the right ventricle of birds when distended in or after death. It is still less likely that any should have remarked the appearance of the valve under these circumstances; which, in truth, could only be striking in very few, as the swan or crane.

Most anatomists, viewing the contracted heart, as it is usually found, with the close valve natural to the more common birds, would very justly conclude that nothing could be more efficient, as a propulsive apparatus. Experiments will be found, however, to prove that a true valve is incompatible with the dilatation that may take place in some birds.

EXPERIMENTS.

A full-grown duck was fed freely with meal-paste, and allowed free access to water. After half an hour, its neck was dislocated. It seemed to struggle a little for about five minutes, and even to breathe imperfectly. The movements had not ceased when the side was opened; and the heart, beating violently, was quickly and easily cut out. The organ was soft, but fluttering actively: the right ventricle was thin, very large, and loose. The auricle was in great part cut away, and a very small pipe fixed in the mouth of the pulmonary artery. Accidentally, a small perforation was made into the ventricle, at the root of the pulmonary artery. The injection of the ventricle was performed slowly; but before it was half full, it was quite manifest that the valve was incapable of closing, in this state of the walls. The fluid (warm water) escaped as fast as it was thrown in. The natural disposition of the *valvular crescent*, under these circumstances, was exceedingly well shewn: it was quite soft and loose; the middle portion presenting a flat surface towards the auricle, and its free edge, directly to the solid wall, without touching it. From this middle point the crescentic edge gradually inclined towards the interior of the ventricle, and at its *attachment of distention* it was turned from the valvular fissure in the greatest degree.

The *crescent of distention* had a very little appearance of being curved in towards the fissure.

Great force was required to fill the ventricle, on account of the narrowness of the pipe, &c.; but, without any degree of distention, the aperture of reflux was extremely wide. The puncture of the ventricle gave passage to a little stream, without otherwise interfering with the experiment, rendering it very difficult to produce a state of distention.

A drake, several years old, had been fed once only, and very scantily; in thirty-six hours. About six hours after the meal, it was poisoned with prussic acid. It struggled very slightly at intervals; and after four minutes, on opening its side, the heart was found beating moderately, and the right ventricle decidedly full. A good deal of delay occurred in affixing a pipe to the pulmonary artery; and the tonic

contraction of the right ventricle had diminished the cavity very evidently, before the injection was commenced. The wide valvular crescent was seen to spread out in the plane of the valvular fissure, as a true valve. The least additional pressure behind it was sufficient to produce a reflux, even during the time of each imperfect systole; so that it was not possible to restore that degree of fulness which had been found at first. The entire heart contracted firmly in about a quarter of an hour.

An old duck, that had been ill fed, was shut up for two days, with as much meal-paste and water as it would take. Its neck was then dislocated; but it continued to stand up, sometimes fluttering, and probably breathing all the while, and still imperfectly raising its head. After about eight minutes, its side was opened, and much blood flowed. The heart beat powerfully: the right ventricle was a good deal distended. The whole was flaccid in the intervals of contractions. On being removed and injected whilst an uniform but rather feeble systole was repeated, it was very plain that a degree of fulness, certainly not exceeding that which had existed *in situ*, was accompanied by a copious reflux. When the injection was stayed, repeated systoles were not able to re-adjust the valve. The free edge of the valvular crescent might be seen inclined slightly into the auricle, and that of the *crescent of distention* was also visible in the valvular fissure. In about two hours, the cavity was moderately contracted, and its valve almost true.

A nearly full-grown goose was decapitated about an hour after a full meal. It bled freely, and without, as I think, ceasing to breathe, its movements were pretty lively, and without any violent struggle for three or four minutes. Whilst still moving, the heart was exposed through the ribs. Its pulsations were rather gentle and uniform. It was empty and loose, most remarkably on the left side. Being removed, and injected with the small pipe of the syringe, it was evidently unable to form a close valve, without very great contraction of the cavity. Long before the cavity was simply filled, the reflux was excessive. Nothing was to be seen of the *crescent of distention**. In thirty hours, the

* Probably on account of the width of the attachment of *distention*.

right side of this heart was become pretty firm, and semi-contracted, or a little more: its valve closed accurately upon injection, but was very easily disturbed.

A black diver had been dead four days. Its right ventricle was thin, and very loose; and, upon injecting it, the valve could not be made to close; the cavity not having contracted in death sufficiently to bring the valve within reach of the solid wall, or within the range of a true valvular action.

A swan's heart was the subject of old cellular adhesions in the pericardium; but the state of its cavities, while in the body, was not observed. Five or six days after its death, without the slightest appearance of softening, the right ventricle being of rather limited extent, both the pulmonary sigmoid, and the crescentic valves, were found to be almost incapable of closing at all. They are still preserved, and are perfectly healthy.

On examining the heart of a large cormorant, the right side of which contained a good deal of blood*, the cavity of the ventricle was found rather capacious, and the walls firm. It was easy, by pressing laterally on the exterior of the auriculo-ventricular fissure, whilst the fluid was gently injected, to make the valve close neatly: but with the ventricle in a state barely full, the valve was not capable of retaining the fluid. The aperture, under these circumstances, was not less than one-third of that of the pulmonary artery.

A large grebe, that had been many days dead, was found, on being opened, to have the right ventricle in a state of semi-contraction. Upon injecting this, the valve might be said to act well, though it did not in any state close perfectly

* The bird had been several days dead—perhaps a week; but it was still in perfectly good condition. It had been shot; but the blood was nowhere extravasated. The injection was performed as on former occasions; the auricle being partly removed.

against the reflux. It seemed certain that a fuller cavity could not have admitted a true valvular action.

A full-grown ostrich had been dead three days. Some water was found in the pericardium: the right ventricle was rather empty, and the auricle was not very full. The substance of the whole was firm. The pulmonary sigmoid valves acted very feebly. The crescentic valve was seen to close accurately, with a very moderate distention; but with a slight increase, it gave way freely.

It was easy to judge satisfactorily of the play of so large a piece of mechanism. If the cavity had been capable, during life, of any material degree of dilatation beyond what we found, the action of the valve would probably have been imperfect.

A buzzard, that had died in confinement five days previously, on being opened, was found to have rather a soft heart, the right ventricle of which was somewhat full. Any degree of force that was sufficient to overcome the mere adhesiveness of the valve, displaced it: indeed, it was quite evident that it could not act as a valve, when the cavity was simply filled up to the same degree as that in which it had been found when first opened.

A strong old raven was poisoned, with about $2\frac{1}{2}$ drops of prussic acid. It did not struggle. Within a minute and a half, it was dead, and the heart exposed. There was no pulsation. The right ventricle seemed to dilate, under the eye, very considerably. The heart was cut out, and the auricle cut off with the scissors: the pipe of the syringe was held within the mouth of the pulmonary artery by the thumb and finger (whilst an assistant guided the handle). This preparation did not occupy three minutes, but the ventricle had already begun to assume some permanent diminution and rigidity: being injected, the valve was seen to close; but a considerable aperture was produced by a slight increase of fulness, without any visible increase of the cavity; and when the apparent distention was scarcely half that which had been first seen, the opening was triangular, with a tendency to eversion (towards the auricle)

in the free edge of the valvular crescent. The cavity soon after became obliterated, by a complete contraction.

A young cock, that had not been fed for thirty hours, was poisoned with prussic acid. It struggled considerably. After about three minutes, its side was opened. The blood came in jets from the arteries. The right ventricle was very much distended: it was large, and loose, when cut out. On injecting this, the contraction of death proceeded so rapidly, that the ventricle was reduced, at the least, to one-half its original extent; but it was remarkable, that at no period, in no state or degree of fulness, was the valve quite true. The tube of the syringe was as small as a common pin: the muscular substance was growing firm. It was not possible to distend or enlarge the ventricle, on account of the escape of the fluid. A complete contraction quickly ensued. In this state, the more considerable curve which the contracting left ventricle must give to the valvular crescent should operate very favourably in producing a true valve. The action of the valvular crescent is to form a straight line, when uninterrupted.

An old fowl was decapitated with a knife, and bled profusely. Its side was almost immediately opened, and the heart found beating freely and steadily; the right side rather full than empty. Being removed, and injected whilst feebly pulsating, the slightest fulness was attended with some reflux; but I am unable to determine if this was, or was not, within the limits of a natural action*.

In order not to multiply the detail of experiments, I would here re-apply a former remark—that it will be found impossible to escape the conviction of the existence of a safety-valve function, and of its structural transitions, if the inquirer will but pay attention to similar experiments in two opposite and remote gradations; as, for instance, in geese and fowls. I cannot, however, forbear to add, that, notwithstanding the precise anatomical adaptation to be found in certain instances—in spite, also, of a true

* I have felt the same difficulty with reference to experiments on the living hearts of pigeons.

valvular action occasionally met with in experiment, I have scarcely yet totally dispelled a doubt that has frequently presented itself, and sometimes forcibly; namely, whether the valve is in any bird altogether insusceptible of a reflux function*.

It has now been shewn, that a certain structural analogy prevails in the right ventricular valve of all double-hearted animals, and that the varieties of arrangement manifestly render the valve more or less liable to disturbance by internal distention. I may be allowed to state, that, whatever obscurity may attach to so extensive a sketch†, I cannot entertain the least uncertainty that the most rigorous test of experiment will but confirm the inference of a *safety-valve*, in numerous degrees, throughout the two classes of animals.

In man, we must still reserve for farther study the varied states of activity of the venous circulation, those of accumulation and obstruction or undue propulsion in the right ventricle, the effects of a difficult or too forcible circulation in the lungs, and the consequences of venous obstruction in the different organs of the body. To these subjects, we can scarcely attach too much importance, whether in a physiological point of view, or with respect to morbid conditions.

* This does not appear unreasonable, anatomically, even with the very type of the close valves before me, in the heart of the China pheasant. The great laxity of the parts whilst living, the distention which seems so readily produced during life in all cases, the relaxation of the *yielding margin* of the valvular aperture, so striking in some experiments, still tempt me to entertain this doubt. In the process of injection, it is impossible to estimate the force employed; but I would recommend, as I have always endeavoured, to adapt the force with great care, beginning by slight degrees, in order, if possible, to produce a perfect closure of the valve.

† It would have been impossible, in this place, to supply a lengthened description of many specimens: indeed, only a part could be referred to. Many experiments have been omitted, from the same cause, as well as some highly interesting circumstances of analogy in the muscular crescent of the ornithorynchus, and in those of the right ventricle of the crocodile.

DESCRIPTION OF PLATE III.

Fig. 1. represents the Interior of the Right Ventricle in the Turkey's Heart.

- A is the convex *solid wall*.
- B is a pretty massive *yielding wall*.
- D is the *attachment* (analogous to a *column*) of *distention*.
- D1. is the *crescent of distention*, very limited in substance and extent, and supposed to correspond to the *anterior curtain of distention* in the Mammalia.
- D2. is the *valvular crescent*, a powerful muscle, and well applied to the *solid wall*: it seems to represent the *right curtain of distention* of a true tricuspid valve.
- F is the rudiment of a moderator band.

This is nearly the lowest degree of a safety-valve; if indeed distention can at all effect the displacement necessary to regurgitation.

Fig. 2. is taken from a Preparation of the Heart of the Stanley Crane.—The whole of the right side was gently inflated; the part was then put into alcohol; and subsequently laid open, by removing great part of the *yielding wall*. The interior of the right ventricle is the only essential part to be noticed. It presents an anterior view of the valvular apparatus. The outline of the preparation does not betray any excessive distention, although the drawing gives something of this appearance; and the extreme thinness of the *yielding wall* is here even less marked than in the original.

The *crescent of distention* is seen crossing the upper part of the ventricle, from the *solid* to the *yielding wall*. The *valvular crescent* is seen below, and posterior to it; and the two crescents are seen to unite at their external insertion (to the left), between which point and the *solid wall* is the widened aperture of reflux into the auricle. The flatness of the *solid wall* is here partially represented.

Some judgment may be formed of the comparative size and thickness of the two ventricles. The left was not subjected to any artificial distention. A section of its wall is shewn at (I).

Admitting this to be an accurate portrait of the parts in their most complete distention, we have still an increase of development beyond what is seen in earlier stages. This is the fullest that I have found in the Grallæ.

The analogy between these parts and those of a simple tricuspid is sufficiently apparent. C is the situation for a *fixed curtain* (supposed).

Fig. 3, and 4, are magnified Views of Preparations from Birds, shewing the Interior of the Right Ventricle, as in the last.—In both of these, we have the thin *yielding wall* without, and the flattened and almost concave *solid wall* within; the *crescent of distention*, thin and membranous, and placed superiorly; and the *valvular crescent*, limited, but muscular, and situated inferiorly. These two are attached, by their united anterior horns, to the *yielding wall*.

Fig. 3. is from the Black Diver; and remarkable, on account of the *yielding wall* being actually not thicker than paper. This bird has, probably, considering its class, a high degree of safety-valve; yet the breadth of its attachment of distention is far less than that of some others of its order.

Fig. 4. is from the Pigeon, which offers a concave *solid wall*, a *crescent of distention*, of small extent; but the attachment between the crescents and yielding wall is rather wide.

These preparations, but especially the last, were distended, and indurated in spirits of wine; and, from their small size and the delicacy of their structures, they have, no doubt, been much disturbed by the process: the differences, however, which they present, in comparison with each other and with the specimens above, are still, to a certain extent, real and remarkable.

The Diagrams 1 and 2 are merely intended to explain two different degrees of a safety-valve arrangement—the elongation of the *crescent of distention* (D1); and the separation of the valvular crescent (D2) from the *solid wall* (A), by the carrying out of the *yielding wall* (B).

Thus we might form the plan of as many different degrees of the reflux function as the class Aves will admit.

The convexity of the solid wall (A) is evidently subject to a gradual diminution, as is shewn by the dotted lines.

It was difficult in this plan to shew the *attachment of distention* (D), varying in length and breadth, and still more in complexity.

Fig 1.

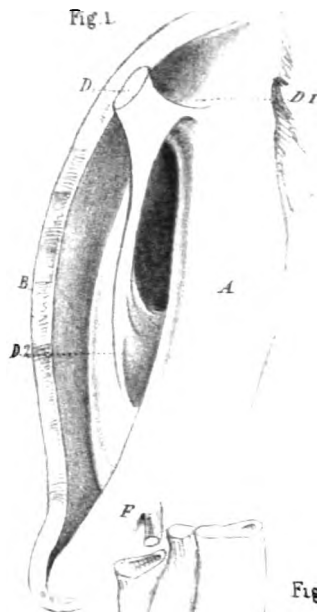


Fig. 2.

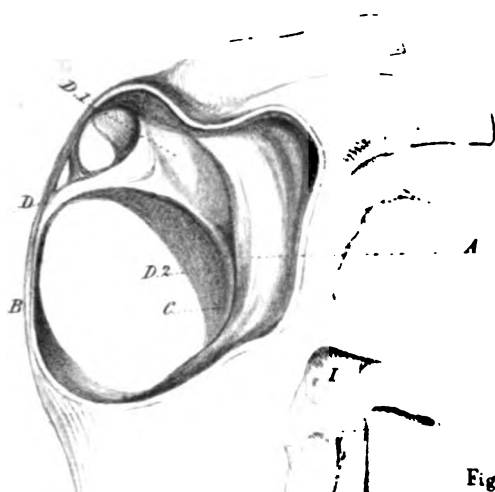


Fig 3.

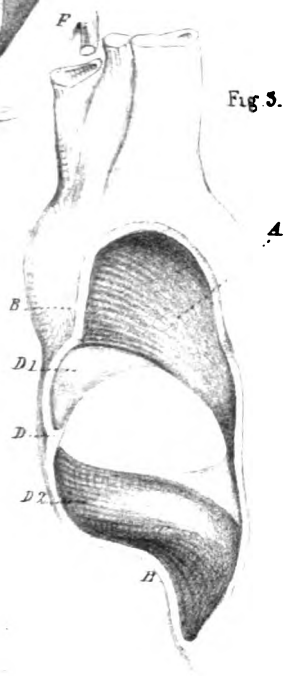
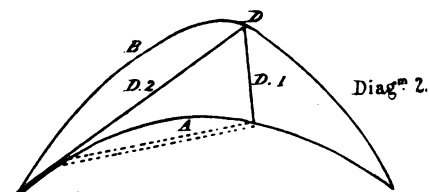
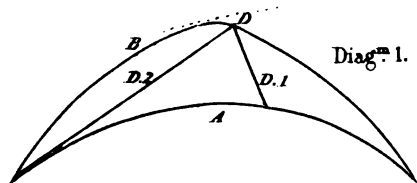
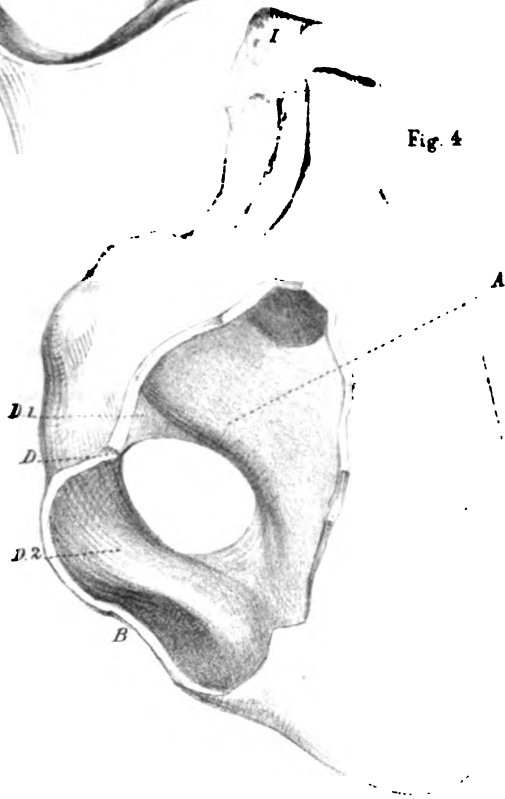


Fig. 4



AN
 EXPERIMENTAL INQUIRY
 RESPECTING THE
 PROCESS OF REPARATION
 AFTER
 SIMPLE FRACTURE OF BONES.

BY MR. BRANSBY COOPER.

THE immediate effects of fracture of bone, and the process employed by nature to repair the injury, have at all times excited the curiosity and engaged the attention of physiologists; but, probably, at no period has the subject engrossed so large a share of professional inquiry as it has done of late years.

Many most distinguished surgeons, both on the continent and in this country, have zealously entered into the investigation; and, as might have been expected, much valuable information has been the result. Sir Astley Cooper has largely contributed to the exceedingly deficient and dissipated materials, heretofore possessed; his additional knowledge of the subject having been derived from the examination of the spontaneous efforts of nature towards the reparation of a fractured bone, watched through the successive stages, as they occurred, in the progress of repeated experiments upon animals.

Nevertheless, it is fairly admitted, that there remains much to be done—that there are many points upon which physiologists are at issue; and that further experiments are required, to place the subject in a clearer light, and on the foundation of sound principles; as, still, too many are inclined to consider the phenomena, attending the accidents incident to bone, as entirely different from those, accom-

panying the action set up by nature in the reparation of the softer parts: whilst, on the contrary, by strict investigation, it will be found that the same laws obtain in both instances; modified, however, in the re-production of bone, by the deposition of a portion of earthy matter, essential to the physical character of that hard and solid structure.

A recent conversation held with Sir Astley Cooper led me to repeat a series of experiments, which he himself had many years ago projected and performed, and from which the contribution contained in this Paper has arisen: and, as no one has thought more deeply, or experimented more extensively, on this subject, than Sir Astley Cooper, so did I find that no one was more anxious for its farther investigation, or more sanguine in the expectation of some new ~~light~~ being thrown upon the process by which nature repairs a solution of continuity in the osseous system.

It was at his recommendation, therefore, and with the advantage of suggestions derived from his experience, that I undertook the task of repeating his experiments; the results of which appear to me to possess some novelty, and are certainly such as I had not altogether anticipated. To minds easily satisfied, and to those who think that the present subject has been amply illustrated and explained, it may reasonably be suggested, that even to go over old ground is often profitable, and, perhaps, in the pursuit, something unexpected may present itself.

As the experiments, necessarily entered into with a view to the investigation of this interesting point, are, of course, numerous, it must not be expected that the subject is to be completed in one article. My object is, moreover, to give a faithful detail of the appearances exhibited, from day to day, in the limb of an animal subjected to experimental fracture, and to present an accurate delineation of the minute alterations which occur in the different structures in the neighbourhood of the fractured bone; deferring theoretical comments on the facts observed, until the completion of my experiments will authorize me to form a just deduction from the results, which I shall then be enabled to lay before the profession. Nevertheless, from the experiments already made, I feel that I shall be justified in detailing the

views I have formed relative to the first efforts of nature towards the reparation, by those tissues immediately influenced by the injury.

I shall proceed, therefore, to the description of the appearances, as they presented themselves upon examination in the experiments, without intending to give the minute account of each dissection; as, in some instances, it would be found that the advance towards reparation of the succeeding experiment varied but little from that of the one immediately preceding;—this circumstance depending, apparently, upon the mode of producing the injury, as well as the age and constitutional powers of the particular animal. In the choice of the rabbits to be subjected to the experiments in question, care was taken to procure them as nearly as possible of the same age and size; and the thigh-bone I considered the best adapted for the investigation of reparative power, in consequence of its being so perfectly surrounded and deeply imbedded in softer structures, which, it seemed to me, would be found to assist greatly in the process of restoration.

The fracture has been produced, in each experiment, in such a manner as to injure the soft parts as little as possible; and the dissection of each animal has been carefully performed about an hour after its death, with the intention that the position of the fractured extremities of the bones might be similarly influenced by the subsequent contraction of the muscles.

Exp. 1.

(See Plate I.)

* A rabbit very nearly full-grown was killed 24 hours after the right femur had been fractured, and the injured limb examined about half an hour after death. Upon removing the skin, great ecchymosis was found, not only between the muscles, but filling also the subcutaneous cellular membrane; the intermuscular effusion of blood being principally on the inner side of the thigh. Still prosecuting the dissection by the separation of the muscles, the bone was found to have been fractured at about the junction of the middle with its lower third, and the fractured extremities widely separated.

The superior extremity was drawn slightly inwards, pressing against the triceps muscle, the fibres of which were partially lacerated; and a distinct spot of ecchymosis marked the precise point of contact of bone and muscle. The inferior extremity was drawn backwards, downwards, and outwards, and in a similar manner pressed against the vastus externus muscle. A laceration of the fibres of the cruræus had occurred on each side of its tendinous attachment to the patella, which was probably produced by the force necessary to break the bone. The periosteum covering each fractured extremity was but very slightly detached from the bone, but partook of the same ecchymosed appearance as the surrounding injured structures, which were, in fact, but with difficulty to be distinguished from each other, in consequence of the general effusion of blood. The interior of each fractured extremity was filled up by a plug of coagulum, which rather resembled the fibrin of the blood than a mass of crassamentum, and which was capable of being raised from the bone in one continuous layer, presenting underneath the appearance of a common clot of blood. This fibrin, filling the cylindrical cavity of the bone, was intimately connected with the coagulum of the effused blood adjacent to the bone fractured.

The same appearance was found at both the fractured extremities, but not to an equal extent; the size of the upper coagulum being greater than that filling the lower fractured extremity.

The result of this first experiment, as already detailed, proves that extravasation of blood is at least a natural consequence of fracture, even if it be not considered as nature's first step towards the means of reparation. This effusion naturally takes place from all the contiguous torn vessels; whence arises the ecchymosis into the surrounding tissues, whether cellular, strictly so called, or into the substance itself of the various adherent or adjoining muscles. A considerable coagulum is, therefore, shortly found in the immediate neighbourhood of the fractured extremities of the bone. The effusion of blood differs in extent in different animals, proportioned, probably, to the force exerted in producing the injury, and varying with the part of the bone where the solution of continuity has occurred.

It is obvious, that, in producing the fracture of a bone, the medullary artery, in common with those of the adjacent tissues, must be ruptured, and coagula be the natural result. A peculiarity in the tissue through which the medullary artery passes, implies something peculiar in its office; which, when the bone is fractured, is readily perceived, by the clot formed from the effused blood of this vessel, remaining permanently distinct from that of the neighbouring arteries.

The clot adherent to the upper broken extremity has already been described to be larger than that sealing the lower fractured portion: this may be fairly attributed to the upper portion of bone, even after the injury, being still supplied by the medullary artery. This experiment was repeated; with results precisely similar to those already detailed.

EXP. 2.

(See Plate II. Fig. 1.)

A rabbit was killed 48 hours after the femur had been fractured. Upon the skin being removed from the injured thigh, the appearance of ecchymosis in the subcutaneous cellular tissue and surrounding muscles was as considerable as in the last experiment. On dissecting the muscles for the purpose of exposing the fractured extremities of the bone, some difficulty was experienced in separating them from the deposition of coagulable lymph uniting them to each other. The bone was found to have been fractured a little below its centre, and its fractured extremities not so widely separated as in the former case; but their relative position, with respect to each other and the adjacent muscles, was precisely the same. The upper portion was resting upon the triceps, and an ecchymosis marked their point of contact: the lower fractured extremity had lacerated some of the fibres of the vastus externus, and a considerable coagulum surrounded this portion of the bone. Between the two fractured extremities, fibres of the cruræus muscle intervened. The fracture was very oblique; which probably had induced considerable irritation, and had led to the laceration of the muscular fibres. The hollow of the upper fractured portion was filled with a clot, firmer and in greater quantity than in the pre-

ceding experiment, and presenting more the appearance of the buffy coat of inflamed blood; this was connected by coagulable lymph with the surrounding tissues. The lower fractured portion was imbedded in the fibres of the vastus externus muscle, and was held in this situation by a deposition of coagulable lymph, which quite surrounded this extremity. The clot filling this portion of bone was not so considerable as that in the upper, but similar to it in appearance. The periosteum, extending to the fractured ends, was thickened, and slightly inflamed; but at the point where the upper shaft of the bone was in contact with, and rubbed on the lower, they were denuded.

The advances towards reparation, which had taken place in this dissection, were first recognised in the greater firmness of the coagulum; which, from its solidity, compared with the clot in the first experiment, tended to give support to the limb, and to limit the extent of motion of the fractured extremities of the bone. The greater firmness of the coagulum was the result of the absorption of the serum, and the consequent condensation of the fibrin, as was indicated by the diminution of its size. The first signs of inflammatory action were also demonstrative of a progress towards reparation; as the deposition of coagulable lymph between the muscles must necessarily tend to limit their motion, and compel the fractured bone to remain in a state of rest—a condition most essential to their restoration and re-union. In this case, the less extent of separation of the fractured extremities of the bone, as compared with those in the first experiment, may be referred to the exhaustion of the irritability of the muscles, from protracted excitement, and a consequent state of relaxation. The attainment of this condition is one step in the progress towards restoration.

We now find, strictly attending to the experiment, that a new feature presents itself; namely, the deposition of coagulable lymph, performing the double purpose of preventing the recurrence of future contraction, and procuring a state of rest for the bone.

Exp. 3.

(See Plate II. Fig. 2; and Plate III. Fig. 1.)

The rabbit was killed 72 hours after the femur had been fractured. On the skin being removed from the injured limb, for the purpose of its dissection, less ecchymosis was discovered than in either of the former experiments, neither was there the same degree of general tumefaction. On proceeding in the dissection through the muscles, for the purpose of exposing the fractured extremities of the bone, it was found that they were with some difficulty brought into view; not only from being surrounded by adhesive matter, but also from being firmly attached to the muscles, at their point of contact, by a deposition of lymph. The dissection having been commenced on the outer side of the limb, the vastus externus was found much thickened, and covered with lymph; which adhered to the biceps, and extended across the bone, completely inclosing its fractured extremity, so that some force was required to detach the bone from the muscle, in consequence of the tenacity of the adventitious matter. On examining the inner side of the thigh, to ascertain the position of the upper portion of the bone, the muscles were found adhering, from the effusion of lymph, as on the outer side; and at the points where the fractured extremity rested on the vastus internus, there was found a considerable alteration in structure, as if the fibres of the muscle had been converted into a substance intermediate between gelatin and coagulated lymph, its fibrous structure being scarcely perceptible; and this adventitious matter precisely fitted the hollow of the fractured bone, and seemed to be connected to the coagulum filling the interior of the cancelli. The shaft of the bone, as high as the trochanter minor, was surrounded by bands of lymph, connecting the periosteum firmly to the surrounding muscles; and the interval between the separated fractured extremities was filled up by layers of lymph; but at the points where the bones were actually in contact, they were denuded of periosteum.

The periosteum of each fractured portion of bone was not only found thickened on its external surface, but also upon its osseous or internal surface, being, apparently, slightly separated from the bone by a deposition of albuminous secretion. The relative position of the broken ends of the bone,

in reference to each other, was the same as in the preceding experiments, excepting that they were rather more parallel, and certainly less moveable. The openings into their cancelli were also filled with lymph, which adhered, on the outer surface, to the new matter thrown out from the muscles; and on the inner, to processes of lymph, produced from the inflamed medullary membrane of the interior of the bone.

The result of this experiment seems to shew a further advance in the reparative process; inasmuch as it is evident that fresh additional structures have, at this stage, become implicated in the progress toward re-union; as, for instance, an alteration in those parts of the muscles on which the fractured ends of the bone have borne. This alteration is greatly advantageous, inasmuch as it obviates the continued irritation upon the muscular fibre; insulating, in fact, the bone from the muscle, and, at the same time, confining it to its new position, serving to prevent an extent of motion injurious to the process of cure. The bands of lymph, passing across from the muscles on one side of the limb to the other, formed an additional means of preventing a wider separation of the fractured extremities of the bones.

EXP. 4.

(See Plate III. Fig. 2.)

The rabbit was killed 96 hours after the femur had been fractured.

The ecchymosis had diminished considerably, particularly in the surrounding structures, so that the muscles and cellular membrane had acquired their natural appearance in a great measure, instead of being infiltrated with extravasated blood. A firm adhesion of the muscles, from the deposition of coagulable lymph, led to the necessity of careful dissection, for their separation, for the purpose of exposing the fractured extremities of the bones. Surrounding the broken extremity of the superior half of the femur, a highly-elastic substance presented itself; which, from a somewhat indistinct appearance of fibres, seems to have been formed out of the cruræus muscle; for these indistinct fibres were traceable as perfectly continuous with those attached to the bone both above and below the fracture, although they were widely separated from the fractured ends by the

deposition of this new matter. On cutting through this dense mass, for the purpose of exposing the ends of the bone, the fibrous appearance was found merely to form a thin layer over its surface; while underneath it presented a more homogeneous structure, paler in colour than its exterior, and having lost all appearance of any fibrous arrangement. Between the extremities of the broken ends of the bone and this substance, a hollow was formed, partly filled by the remains of coagula, but chiefly by lymph; several bands of which, apparently organized, had become connected with the coagulum along the cancellated structure of the upper broken end. The end of the inferior fractured portion was inclosed in a similar hollow on the great posterior mass of muscles; the fibres of which, being torn, had become infiltrated with lymph of a very opaque colour, and of considerable density, as if to form a capsule to protect the muscle from the irritation of the roughness of the bone; and in this hollow, as in the upper one, coagula and lymph were deposited. A portion of this highly-elastic semi-cartilaginous substance, into which the crureus muscle seemed as if converted, was exposed to the following examination:—A thin slice was placed between two plates of glass, and, upon being pressed, was found to resist the pressure, sliding and slipping away like a piece of cartilage, and without permitting itself to be flattened, like muscle or any other softer substance.

When viewed beneath the microscope, it appeared as if the fibres of the muscle had been widely separated, infiltrated with lymph, and rendered more opaque; while in their interstices was a softer opaline lymph, in which were seen globules of albumen. This cartilaginous appearance was more perfect, the nearer the part examined to the fractured extremity of the bone; and the substance was fibrous only at the periphery, and above the fracture, where its attachment to the bone was truly muscular. A small portion from the centre of this mass, pressed with great force between the plates of glass, was crushed with a sensible noise; and the fibres, thus widely separated, broke off into short rectangular portions, as if with increased density they had become brittle. Healthy muscular fibre, treated in a similar manner, was squeezed out into a broad thin uniform plate, in which fibre

could be with difficulty traced, having apparently become disorganized by the force used.—The preceding details were the result of the repetition of a similar experiment; the first one not being considered conclusive, in consequence of the injury sustained by the violence inflicted in producing the fracture. This seemed to have interfered with the reparative process; although some efforts similar to those already described, but infinitely less advanced, had taken place. In that first experiment, the fractured portions of the bone were, at one point, in contact: here they were denuded; and the periosteum at the edges of the denuded bone had become very much thickened, and cartilage was deposited in the direction tending to inclose the two fractured ends of the bone; so that the periosteum seemed, in this case, alone to be employed in a process, which, in the second case, was aided by the action set up in the muscular system.

EXP. 5.

(See Plate IV. Fig. 1.)

The rabbit was killed 120 hours after its femur had been broken.

Upon removing the skin from the injured thigh, but very slight remains of ecchymosis presented itself; but the subcutaneous cellular tissue, muscles, and aponeuroses, had all resumed their natural appearance upon the absorption of the extravasated blood. Before any further dissection was prosecuted for the purpose of exposing the fractured ends of the bones, a distinct circumscribed tumor could be perceived under the muscles, which seemed to surround the fractured ends of the bones, from the degree of resistance it offered to any but a slight degree of motion. On proceeding to dissect the muscles from the surface of this tumor, and commencing on the outer side, the vastus externus was found so closely adherent to it, that only a forcible or arbitrary separation of them could be accomplished; the deposition from the surface or cellular membrane of the muscle having become a part of the callus surrounding the bone. The lower fractured end of the bone, where resting on the surface of the biceps muscle, was firmly retained in its situation by a deposition of cartilage, which surrounded

the rough surface of the bone, and was adherent to the fibrinous coagulum filling up its cancelli. The muscles were then removed from the inner side of the thigh; where the vastus internus was found equally intimately connected with the callus, and was separated with the same difficulty as on the outer side; but the fibres of these muscles, both above and below the parts influenced by the fractured bone, were readily and naturally separable from the periosteum of the shaft of the bone. In this deeper dissection of the muscles there was but little appearance of blood. When the muscles were removed from the entire surface of the callus, the fractured extremities of the bone were found completely surrounded by a substance, conveying to the touch the sensation of a cartilaginous cyst, containing a fluid within its thick parietes. A section was made through this cartilaginous mass, exposing the upper shaft of the bone: it left, however, perfectly distinct, the cut edge of the periosteum, which could be traced as far as the fractured extremities of the bone, at which point the callus dipped down so as completely to fill up the medullary cavity; being thus connected, by new organic matter, with the fibrin which, from the first, appears to occupy the opening into the cancellated structure. That portion of the callus immediately surrounding the fractured extremities was considerably less firm than that towards the periphery; dense fibres of organized lymph being intermixed with matter of a softer character and darker colour.—The rabbit, the subject of this experiment, was in full health and vigour, at the time the fracture was produced; and from the perfectly transverse direction of the fracture, less general injury was inflicted on the surrounding tissues: hence the great advance made in the consolidation of textures beyond that described in the last experiment, which, as further experiments will shew, was not solely attributable to the restorative progress of twenty-four hours. In consequence of the density of the cartilaginous tumor surrounding both portions of the bone, but little motion was allowed to influence the healthy progress of the cure; but yet, as whatever movements took place in the limb were chiefly determined upon the part immediately investing the sharp edges of the

fracture, we found the centre of the callus less uniform, and of a less dense character ; conveying the impression, when the tumor was pressed upon externally, that a fluid was contained within its centre.

EXP. 6.

(See Plate IV. Fig. 2.)

The rabbit was killed 144 hours after its thigh had been broken.

Upon the skin being removed, there was less general appearance of disturbance in the soft parts than had been indicated in the former experiments ; unless, perhaps, we except the subject of the last, which was nearly a full-grown animal, and in every respect particularly healthy. Before the removal of any of the muscles, a distinct circumscribed tumor was perceptible ; corresponding, in most respects, to that of the preceding experiment ; but it was somewhat smaller, although to the same degree it prevented the motion of the fractured ends of the bone. On making a section of this cartilaginous deposit on the anterior surface of the femur, in the same manner as described in the last examination, much the same appearances presented themselves, and need not, therefore, be repeated. It is to be observed, however, as delineated in Plate IV. Fig. 2, that the bands of adhesive matter, between the fractured ends of the bone, had arrived at a higher degree of organization, and were, in every point of view, better fitted to restrain motion. Each fractured end of the bone was surrounded by an altered structure in the muscles on which they rested ; but there was rather more softening in this adventitious matter than in the last experiment, probably from the nature of the fracture, which, from its obliquity, tended to keep up a continued irritation : this effect was more particularly obvious on the inner side of the limb. The fibrin filling up the extremity of the lower fractured end of the bone was firmly connected with bands of lymph interposed between the fractured portions, proving how mechanical disposition can interfere even with nature's powers : for, under common circumstances, the upper fractured portion, *cæteris paribus*, would have advanced infinitely further towards reparation than the lower, receiving a better supply

of blood from the integrity of the nutritious artery being preserved.

EXP. 7.

(See Plate IV. Fig. 3.)

The rabbit was killed 168 hours after its femur had been broken.

There was nothing worthy of remark, as deviating from the results of the last experiment, in prosecuting this dissection, until the callus surrounding the fractured extremities of the bone was removed from the anterior and posterior aspects of the limb; upon which, the following advancement towards reparation presented itself. First, on the anterior surface, between the broken ends of the bone, the newly-deposited lymph was found converted into a firm cartilage; so completely adhering to each portion of bone, and covering their extremities, as to unite them firmly together, and bring them into pretty close contact. On the posterior view, the cartilage was highly vascular; and the surface of the bone to which the cartilage was attached was irregular, as if worm-eaten, softened, and presenting in some degree a granulated appearance, upon which little specks of deposition, of mortar-like concretions, could be detected, lying close upon the bone. Before the callus had been disturbed, upon moving the overlapping extremities of the bone upon each other, not the slightest sensation of crepitus could be produced, but merely the degree of motion permitted by the elasticity of the adventitious deposited matter, unattended by any grating noise or feel. The principal advancement towards restoration in this experiment seems to be, the close approximation of the two portions of bone, and the softening of their surfaces from the absorption of their earthy matter; evincing, by the concretions of bony matter which were found deposited in the situation where the bone was denuded of its periosteum, what structure is most employed for the completion of their union.

EXP. 8.

(See Plate V.)

The rabbit was killed 192 hours after the thigh-bone had been broken.

On commencing the examination on the outer side of the limb by removing the muscles, the spot where the lower portion of the fractured bone was in contact with the biceps, it was found converted into distinct cartilage. Upon dissecting off the muscles to expose the whole of the callus, the sciatic nerve was traced, running in a groove in the callus, and about opposite the middle of the thigh-bone, on the outer side. Just by the origin of the vastus externus, there was observed a vascular sulcus in the callus, appearing to form an opening leading to the two fractured extremities of the bone; but upon attempting to expose them, a quantity of vascular adhesive matter was found completely to enclose them. In all the former experiments, the fractured ends of the bone were obliquely situated, with respect to each other; but in this of the eighth day, they were quite parallel, although they overlapped. The investing callus, in this case, was much more extensively developed posteriorly than anteriorly; and no crepitation could be produced by motion of the bones.

On removing the cartilage from the anterior surface of the bone, close to the fractured extremity of the upper portion, it was found highly vascular, forming a kind of membranous capsule, which was attached to the lower fractured portion. On further removal of the cartilage, so as to examine between the bones, a great number of bands of adhesive matter, studded with cartilage and earthy deposits, tied the bones together; which seemed to derive their vascularity, in part, from the bones themselves, which were denuded, and had undergone the same changes as described in the last experiment, where the bones had also been deprived of periosteum. The cartilages filling up the calibre of the fractured extremities were also studded with bone.

It is to be observed therefore, in this experiment, that a considerable advance towards ossific union had occurred; and more particularly in the close vicinity to the bone; proving, however sufficient the surrounding soft structures may be to the deposition of cartilage, that the bone, at any rate, first deposits earthy matter: for the fibrin, filling the cancelli, was partly converted into bone, as well as the adhesive matter between the two fractured extremities.

Upon placing small portions of these deposits under the microscope, opaque spots were observed, deposited upon a semi-transparent ground of thin cartilage. When these portions were moistened, and firmly pressed between two pieces of glass, the opaque particles gave a gritty sensation, and manifested all the physical properties of fragility; while the translucent parts split and slid under the glass, like moistened cartilage.

GENERAL REMARKS.

On taking a retrospective view of the various effects produced by fracture of a bone, as detailed in the foregoing experiments, it will be my object to recapitulate the appearances, in the order they presented themselves; by which means we may be enabled to discover the process which Nature adopts for the reparation of injured parts, when the work of restoration is left to her alone. The first effect produced in the solution of continuity of bone—as, indeed, must inevitably occur in lesion of any vital parts—is, extravasation of blood; and even this first effect involves a very important question, as to the purpose to which that blood is to be applied. The immediate effect of this extravasation is, to infiltrate the cellular membrane in the vicinity of the fractured extremities of the bone and of the surrounding muscles, with blood, which, by its coagulation, immediately produces two desirable results; first, in effecting a degree of stiffness in the injured limb, which prevents the tendency to motion; and, secondly, in restraining a further hæmorrhage, by plugging up the torn blood-vessels, both of the bone and of the softer structures. The firmness of the coagulum filling up the cancelli of the two fractured ends of the bone is the principal feature to be observed, and, I believe I may say, the first step towards reparation, after the infliction of the injury. So soon as the coagulum has effected this important object of staying hæmorrhage, its fluid parts begin to be absorbed, and the tumefaction of the limb to diminish; while the firmer parts of the blood still produce the bene-

ficial effect of giving solidity to the limb. Little change beyond this is to be observed forty-eight hours after the accident, the coagulum only being found firmer than on the examination made at the end of the first four-and-twenty hours. On the third day, the surrounding tissues begin to be inflamed, from the irritating influence of the coagulated blood; as evinced by the deposition of coagulable lymph, by which the muscles become connected to each other, and their power of contraction diminished, leading to a further means of preventing motion in the fractured ends of the bone. At this period, also, it is to be observed that the coagula, closing the cancelli of the two ends of the bone, are firmly united to the medullary membrane, as well as to the surrounding deposited lymph; and must, in some degree, therefore, assist in maintaining a state of rest. The inflammation induced in the surrounding soft parts still continuing, leads to the effusion of more adhesive matter: at the same time, the ecchymosis becomes less, and paler in colour, and the general surrounding tissues more distinct. From this period, the effused adventitious matter begins sensibly to thicken, and to acquire increased firmness; from a gelatinous effusion, forming a distinct tumor around the fracture, of sufficient solidity to limit still further the motion of the parts, and completely to prevent the muscles being irritated by the irregular ends of the bone. If at this period—namely, between the fourth and sixth days—the callus be examined, it will be found intimately intermixing with the surrounding muscles, at the points opposite to the fractured ends of the bone; and, internally, it is also connected with the periosteum and coagula filling the cancelli, thus isolating the fractured bone from the surrounding structures. After this, all the appearance of ecchymosis entirely ceases; and the only portion of the original coagulated blood which now remains, is that plugging up the ends of the bone, the fibrin of which appears to have become organized; and therefore it may be said, that the original extravasated blood in part assists in the reparation.

The progressive steps towards union, up to this point, are liable to an interruption, either from the want of constitu-

tiona^l power in the animal, or the extent of injury done in producing the fracture; so that some of the experiments required to be repeated. About the sixth day, further consolidation ensues; the surrounding muscles appear distinct from the callus, excepting at the points opposite to the ends of the bone. The diffused matter has now both the appearance, firmness, and elasticity of cartilage; and, by its contraction, which occurs simultaneously with its increased density, tends to bring the hitherto separated fractured ends of the bone parallel, although they overlap each other, through the influence of the muscles. At the points where the bones come in contact, the periosteum is absorbed; but in all the other parts, this membrane is inseparably connected with the surrounding mass, much thickened, and easily detached from the bone, so as to give the appearance of the bone having been deprived of its periosteal covering; but the fact is, that it has only become blended with the effused callus. The portions of bone, where denuded, are softened, granular, and seem to be endued with a higher degree of vascularity than healthy bone, probably from the absorption of its earthy constituents. Here it is where the first traces of earthy deposition seem to commence; so that it would appear that the surrounding structures so far assist in the reparation of a fractured bone, as to induce approximation, limit motion, and diminish the irritability and contraction of muscle; while the osseous system itself deposits the earthy matter essential to hardness, the grand characteristic of bone. This view, however, is to be considered as somewhat speculative, as it requires further experiments to prove its validity: at any rate, it is shewn that all the soft parts participate in the injury, and perform a very important office in the completion of a cure: this is rendered more obvious, by the consideration of the inefficiency of the bones of the cranium, neck of the femur, and some other bones, not surrounded by cellular and muscular systems, to work their own reparation. It is nevertheless certain, that so early as the seventh day, in some instances, and the eighth and ninth day in others, earthy matter is secreted in the dense cartilaginous mass in the immediate neighbourhood of the fractured bones. Small

specks of the same deposit are observed, at this period, in the fibrin which closes the opening of the broken extremities, and, at a more advanced time, completely shuts up these canals with a firm septum of bone. If sections of the cartilage be made in the mass surrounding the ends of the bone, and placed on glass and dried, the white earthy matter is rendered clearly visible, deposited in minute specks in this more transparent substance.

PLATE I.

Represents the thigh of a rabbit, in which the femur had been fractured 24 hours before death. The fracture is oblique; and the inferior portion, as described in the detail of the experiment, drawn backwards, outwards, and upwards. A large portion of the triceps muscle has been removed from its insertion into the upper shaft of the femur, in order to display the displacement of the lower fractured portion. Extensive ecchymosis is observable on the surface of all the muscles contiguous to the injured bone, especially upon the upper and anterior side, between the cruræus muscle, which is stretched over the sharp extremity of the upper half of the femur and the rectus, and between the latter muscle and the vastus externus. The rectus is easily distinguished, by its blueish glistening aponeurosis. The hollow of the upper cylinder of bone is occupied by a large and dark coagulum; while a smaller and less dark-coloured plug seals the aperture of the lower fractured bone.

Plate 1.



Hurst del.

Drawn on Stone & Engraved by T. Fox
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Fig 1.

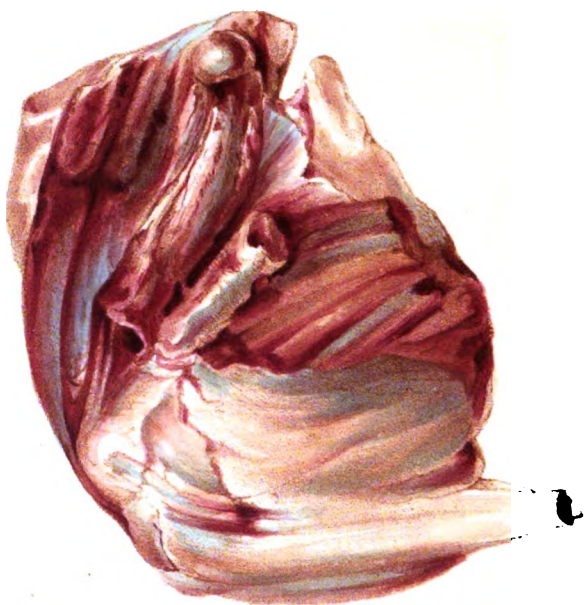


Fig 2.



PLATE II.

Fig. 1. represents the limb of a rabbit, similarly fractured, at the expiration of 48 hours from the period of the injury. The ecchymosis is less extensive, but occupying similar spaces amongst the muscles. The cruræus is seen, in this instance as in the former, stretched over the sharp transverse fracture of the upper portion of the femur. The coagulum closing this broken extremity is greater and less dark than in the last experiment; while bands of lymph or fibrin are to be observed passing between the two divided and separated portions of the bone. The fibrin of the blood, much deprived of the colouring matter, closes the cylinder of the lower portion of bone.

Fig. 2. exhibits the posterior view of the femur of a rabbit, 72 hours after the fracture. The hollow of the lower portion of the bone, which is seen to the right of the Plate, is occupied with the remains of a large coagulum, intermixed with deposits of lymph which has already begun to be organized;—red vessels shooting into it, in various directions. Lymph, partly organized, is seen surrounding the bones in considerable quantities, which is still more observable in Plate III. *Fig. 2.*

It should be remarked, that the drawings made of *Fig. 2.* Plate II.; *Fig. 1.* Plate III.; *Figs. 1, 2, and 3.* Plate IV.; and Plate V.; were all taken from specimens which had been previously preserved in spirits of wine: so that the cartilage was both rendered more opaque, and had lost somewhat of the brightness of tint which distinguished its recent condition. This especially applies to parts in the immediate vicinity of the broken ends of the bone.

PLATE III.

Fig. 1. exhibits an anterior view of the same femur as in Plate II, *Fig. 2*, in which a section has been made through the mass of lymph surrounding and binding together the separated shaft of bone. The upper portion of femur has here been purposely denuded of its periosteum, by the section to shew how the lymph has been deposited on the exterior of that membrane; and that it has already, by its pressure amongst surrounding tissues, obtained a cellular or firm membrane or capsule which encloses and circumscribes this deposit, being a first step to the formation of a cartilaginous callus.

Fig. 2. represents the rabbit 96 hours after the fracture. The two portions of the femur are less widely separated than before. Lymph organized and firm occupies the openings of the upper and lower portions of the bone. The ecchymosis has nearly disappeared, but the muscles in the immediate neighbourhood of the seat of injury are thickened and altered in texture. The crureus, which may be observed extended over the edge of the fracture in the upper half of the femur, is much thickened, and its fibres infiltrated by a dense semi-cartilaginous effusion, described in the 4th experiment.

Fig 1



Fig 2



Fig 1



Fig 2

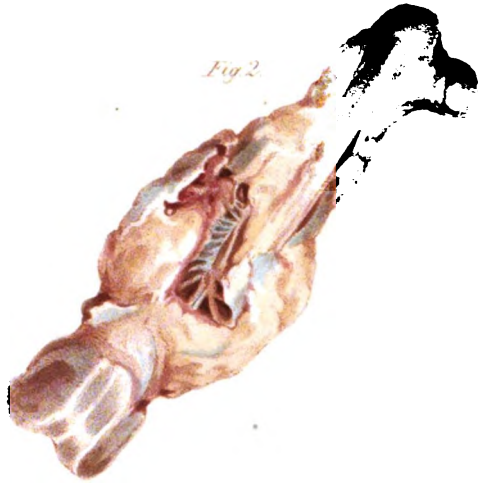


Fig 3



PLATE IV.

Fig. 1. exhibits a similar fracture to those already described. This, however, is prepared, after the fifth day, or 120 hours, from the receipt of the injury. The two portions of the shaft of the femur are surrounded by a dense cartilaginous tumor; which may be observed to be the result of effusion exterior to the periosteal covering of the bone; as the cut edge of this membrane is exhibited by the pale line following the upper portion of the femur in close adhesion to it, as far as the fracture itself. Notwithstanding the motion of the bone is much limited by the density of the callus, sufficient still remains to prevent the entire consolidation of the cartilage, immediately round the seat of fracture, where the structure is less homogeneous, and hollowed into cells filled by bloody serum. The structure here is also more vascular, as if inflamed.

Fig. 2.—The preparation is taken from the limb of a rabbit, 144 hours after the fracture (sixth day). The cartilaginous mass surrounding the two portions of bone is less firm, and less defined than in the preceding instance. The fracture, in this case, was more oblique; the edges of the bone sharper; and perhaps more motion had taken place between the two edges of the fracture than in the last specimen. The evidence of this, indeed, is found in the greater looseness of structure in the callus thrown out between the bones; and by the development of the bands of lymph passing from the sides of the upper to the lower portion of bone, to counteract the tendency to motion.

In *Fig. 3.*, 168 hours after the fracture, the bones are still more widely separated.—The limb, in this instance, is viewed posteriorly; a section being made, as in the former cases, through the callus. The upper half of the femur overlaps the lower more than we have yet seen; but they are surrounded by a dense cartilage, in which are deposited specks of earthy matter, not represented in the drawing; as from the opacity of the cartilage itself, little distinction of colour exists, until sections have been made and dried on glass, when the bony deposit becomes plainly visible. In the lymph which fills up the hollow of both ends of the bone, in this and in the preceding experiment, earthy matter had already been secreted, and also *in the cartilaginous effusion, at some distance from the periosteum itself.*

PLATE V.

Displays the dissection of the thigh-bone of a rabbit, which had been fractured 192 hours previous to the destruction of the animal. A section has been made through the callus, so as to present an anterior view of the bone. By this section, the upper fractured portion of the bone has been completely exposed; and the periosteum partly removed, so as to shew how the adventitious cartilaginous deposit is placed on the outer side of that membrane, between it and the aponeurosis of the muscles, which is delineated by a whitish line. It may also be observed, that the periosteum is slightly separated from the shaft of the bone; and between them a deposition of coagulable lymph has been poured out; not presenting, however, the same degree of vascularity as the deposition on the outer side of the periosteum; as indeed might be expected, from the less degree of vitality of the intervening structures. The fibrin enclosing the cancelli was firmly adherent to the medullary membrane; and small specks of earthy matter were seen deposited upon its inferior surface, as the Plate represents.

The section through the callus, it is to be observed, has not, in a similar manner, exposed the surface of the inferior fractured portion of the bone, in consequence of its having been drawn to a plane posterior to the upper portion; but it shews the high degree of vascularity of the callus, where attached to the periosteum; and some small specks of earthy matter may be seen deposited upon it. The upper and lower portions of the bone, in this Preparation, were much nearer parallel than in any former experiment, and in every respect exhibited a further progress towards ossific union.

Plate V



REPORTS
OF
OBSTETRIC CASES
IN
PETERSHAM WARD.

WITH OBSERVATIONS
BY DR. ASHWELL.

SUMMARY OF CASES OF FEMALE SEXUAL DISEASE RECEIVED INTO
PETERSHAM WARD, FROM NOV. 1835, TO DEC. 1836, INCLUSIVE.*

| | | | |
|-----------------------------------|----|------------------------------------|----|
| Abortio - - - - - | 1 | Indurat. Oris Cervicisque Uteri, 4 | |
| Amenorrhœa - - - - - | 14 | Inflammatio Mammæ - - - | 3 |
| can Choreâ - - - | 1 | Inflam. Oris Cervicisque Uteri, 2 | |
| Epilepsiâ - - - | 1 | Irritable Uterus - - - - - | 3 |
| Hemiplegiâ, 1 | | Leucorrhœa - - - - - | 5 |
| Tæniâ - - - | 1 | Menorrhagia - - - - - | 5 |
| Anæmia - - - - - | 1 | Polypus Uteri - - - - - | 2 |
| Carcinoma Uteri - - - - - | 6 | Procidentia Uteri - - - - - | 4 |
| Vaginæ - - - - - | 2 | Prolapsus Uteri - - - - - | 4 |
| Chlorosis - - - - - | 8 | Vesicæ - - - - - | 1 |
| Contractio Vaginæ - - - - - | 1 | Puerperal Convulsions - - - | 2 |
| Climacteric Disease - - - - - | 2 | Tumor Abdominalis - - - - - | 1 |
| Dysmenorrhœa - - - - - | 1 | Meatus Urinarii - - - | 1 |
| Fungoid Excrescence - - - - - | 1 | Ovarii - - - - - | 4 |
| Fungoid Disease of external | | Uteri - - - - - | 1 |
| Genitals, with Pregnancy - 1 | | Vesico-Vaginal Fistula - - - | 2 |
| Hydrops Ovarii - - - - - | 6 | | |
| Hysteria - - - - - | 1 | Total - - - - - | 95 |
| Imperforatio Vaginæ - - - - - | 2 | | |

* For the statistical materials comprised in this department of the Reports, I am again indebted to the persevering accuracy of Mr. J. C. W. Lever, one of the Obstetric Clinical Clerks of the Hospital.

Abortio.—The case of abortion was induced by the patient's attempting to lift a heavy weight. On her admission into the Hospital, she was suffering from all the symptoms of loss of blood. The sulphate of quinine, generous diet, porter, and rest in the recumbent posture, succeeded in restoring her system to its proper tone.

Amenorrhœa.—The cases of amenorrhœa were, in number, eighteen. Ten of them were cases of simple amenorrhœa: two occurred in patients of highly plethoric habits; and the remaining six were complicated with local affections. The cases of simple amenorrhœa were treated by aperients, metallic tonics, and emmenagogues. Injections of liq. ammoniæ and milk, in the proportion of m. x. of the former to ʒi. of the latter, were successfully employed in some cases; while several appear to have derived considerable benefit from electricity—a remedy frequently resorted to in the ward, during the last twelve months. In those cases where the healthy condition of the alimentary canal has been restored, and uterine torpor continues, slight electric shocks, passed through the loins, advantageously stimulate the genital system, and, occasionally, at once induce the catamenial secretion. Still, electricity is uncertain; and it will often be employed unsuccessfully: in some instances, the alarm attendant on its use has cured the amenorrhœa, by suddenly exciting menstruation. The six cases of complicated amenorrhœa were very interesting. In one, it was associated with chorea. This patient, after protracted treatment, was eventually cured by sulphate of zinc, and the injection of liq. ammoniæ into the vagina. In another, amenorrhœa was complicated with epilepsy. The medicine prescribed was ferri sulph. gr.i. pulv. digitalis gr.i. pulv. myrrhæ gr.ij. mucil. Acaciæ q.s. fiat pilula ter die sumenda. It is worthy of remark, that these pills were persevered in for three weeks, without any injurious consequences from the use of the digitalis; a circumstance attributable, probably, to its combination with the iron. At this period, the catamenia appeared; and there has been no return of the fits. In a third case, hemiplegia was attendant on the amenorrhœa. This complication was tedious, and difficult to manage. At first, the mist. ferri c. was prescribed; afterwards, the sulphate of

zinc; and an iodine liniment was well rubbed over the spine, night and morning. Menstruation was eventually established, and the patient regained the entire use of the side. In the fourth case, there was tænia with the amenorrhœa. In addition to the other remedies, the ol. terebinth. was curatively employed. In the fifth patient there was vicarious discharge from the mamma, in conjunction with amenorrhœa: the mist. ferri c. was ordered, as well as the daily employment of the ammoniacal injection. The last patient had, in addition to the amenorrhœa, a peculiar nervous affection of one of her lower extremities, which completely subsided when the catamenial function was, by appropriate remedies, healthily established.

Anæmia.—This patient was suffering from a considerable loss of blood after delivery, occasioned by a partial adhesion of the placenta to the uterus. Tonics, nutritious diet, and astringent injections, soon restored her to a state of convalescence.

Carcinoma Uteri. } Six cases of carcinoma affect-
Carcinoma Uteri et Vaginæ. } ing the uterus alone, and two implicating both the uterus and vagina, have been admitted. The former consecutively presented the various indications of the disease, from the scirrhus hardness, to complete ulceration, with fungoid growth. In the two latter, the inguinal glands were enlarged and indurated. These distressing maladies were treated, by preventing, as far as possible, every cause of irritation; and by the cautious exhibition of anodynes, by the mouth, by injection, and as suppositories within the rectum. Occasionally, considerable relief was afforded by a plaster of the extract of belladonna, applied over the sacrum and loins.

Chlorosis.—There have been eight instances of chlorosis comprising both the simple and complicated forms of the disease. Purgatives, tonics, and emmenagogues have been the medicines employed; suiting their exhibition, combination, and dose, to the various cases. (See Reports, Vol. I. p. 529.)

Contractio Vaginæ.—This occurred in the person of a woman, aged 30, who had given birth to five still-born children. From some unknown cause, inflammation occurred

in the posterior part of the vagina, followed by an abscess; in the healing of which, so great contraction occurred as materially to interfere with intercourse. A bougie was ordered to be applied daily; and she left the Hospital considerably improved.

Climacteric Disease. The two cases of climacteric disease occurred in persons above fifty years of age, and well portrayed all the symptoms so excellently described by Sir H. Hallford, in his Essays: they had both contracted second marriages late in life, and had suffered, although in a very slight degree, from leucorrhœa. Astringent injections, the employment of stimulants with tonics, as the *inf. serpentariæ*, with the *ammonia sesqui. carb.*, comprised the treatment.

Dysmenorrhœa.—This patient was twenty-two years of age; and had been affected with difficult menstruation for four years, the pain recurring with great intensity about twenty-four hours before the accession of the catamenia, and ceasing as the flow increased. Hyoscyamus and camphor, with the hip-bath, were the remedies employed during the period; and the iodide of iron during the intervals of menstruation. She left the Hospital well.

Fungoid Disease of external Genitals, with Pregnancy.—See Case, p. 247; and Drawing by Mr. Canton, p. 267.

Fungoid Excrescence.—This woman, when admitted, was forty-seven years of age: she had twice miscarried, and had borne five living children; the birth of the first being followed by hæmorrhage, so excessive as to endanger her life. For two years before admission, she had had sanguineous discharge, at intervals. On examination, a fungoid excrescence was found to protrude through the os uteri, probably growing from the lining membrane of the uterus: by the aid of the speculum, veins were seen to ramify over the tumor, which bled on the slightest exertion or emotion. Astringent anodyne injections into the vagina, to allay the pain and repress the hæmorrhage, with anodynes and tonics, comprised the treatment. At her own desire, the patient was presented; the disease having all but destroyed her life. The plug of tow, dipped in alum water or tincture of galls, was strongly recommended.

Hydrops Ovarii.—Six cases of ovarian dropsy have been

received for treatment. Of these, four were married, and two were unmarried women: in three, the disease commenced on the right; and in three, on the left side. Two only were tapped, and both successfully: in one, the operation had been performed before. Their ages were as follow:

| | | | |
|----------------------------------|----------|-------------------|-------------|
| Unmarried | 39 . . . | left side . . . | stationary. |
| Married, 1 child | 38 . . . | left ditto . . . | ditto. |
| Married, 1 child, 3 mis. | 51 . . . | right ditto . . . | tapped. |
| Married, 7 children | 45 . . . | left ditto . . . | increasing. |
| Married, 1 child | 51 . . . | right ditto . . . | tapped. |
| Unmarried | 30 . . . | right ditto . . . | died. |

Hysteria.—There has been but one case of an hysterico-epileptic nature; which required local bleeding, purgatives, and the subsequent employment of the *mist. assafœtidæ*.

Imperforatio Vaginæ.—Two cases of *Imperforatio Vaginæ* have been received for treatment. One, the instance of Elizabeth Rusher, is fully described hereafter. The other occurred in the person of a girl, aged 17. She had for nearly eight months complained of great pain in the loins, and other symptoms, which led to the suspicion of the mischief. On examination, the labia were found separated by a projecting tense body, resembling, in form and feeling, the membranes containing the *liq. amnii*, during pain. An opening was made; and about two quarts of a thick fluid escaped, having the appearance of melted *emp. roborans*. The vagina was injected with warm water; and, on examination, the *os uteri* was felt, high up, dilated to the size of a shilling, and the upper part of the canal was very capacious: a piece of lint was placed in the opening, and she shortly left the Hospital, cured.

Induratio Oris Cervicisque Uteri.—*Leucorrhœal* discharge, with more or less of central pain, marked the whole of these cases. In three, the anterior limbus of the *os uteri* was indurated, and micturition was painful and difficult. In the fourth case, the posterior limbus was affected; and there was pain and difficulty in emptying the rectum. For treatment, reliance was chiefly placed on the internal administration and the external application of iodine, as enjoined in the paper on hard tumors of the uterus, in Part I. Vol. I.

Inflammatio Mammæ.—The three cases of mammary

inflammation occurred in first confinements: before admission, abscess had taken place. Tonics, as the quinine, porter, &c., were administered, to support the patient's powers during the process of suppuration.

Inflammatio Oris Cervicisque Uteri.—These cases were marked by the creamy discharge; pain in the erect position, greatly increased by examination; &c. Cupping on the loins, anodyne injections, mild laxatives, with hyoscyamus, and absolute rest in the recumbent posture, comprised the whole of the treatment.

Irritable Uterus.—In these three cases, there were the usual symptoms; pain in the lower part of the abdomen, passing round to the loins, and running along the brim of the pelvis: relieved, but not removed, by the recumbent position. The hip-bath, hyoscyamus and camphor, assisted by the employment of anodyne injections and suppositories, mitigated the pain; while tonics, as the calumba, cascarilla, and quinine, were administered, to maintain the powers of the constitution.

Leucorrhœa.—Five cases of leucorrhœa were received for treatment: in all, the discharge was very profuse, and had continued so long as to produce many of the symptoms of loss of blood; as, pallor of the surface, œdema, dyspnœa, &c. The treatment consisted in enjoining the strict and periodical employment of astringent injections; as, the lot. alum. c., the lot. arg. nit., or the lot. ferri sulph. In administering tonics, both mineral and vegetable; of the former, the sulphate of zinc and the mist. ferri comp. were preferred; of the latter, gentian, calumba, cascarilla, and quinine.

Menorrhagia.—Two of these cases may be stated as active, and three as passive menorrhagia. To the former, there were conjoined all the attendant marks of plethora; as, fullness about the pelvis, heat and throbbing of the genitals, full pulse, tumid and painful mammae: these were treated by cupping from the loins, saline purgatives, and refrigerants. The three cases of passive menorrhagia occurred in married women, who had had profuse leucorrhœa for some considerable time. Great benefit was derived from the employment of the ergot of rye, both internally, and externally, in the form of injections.

of polypus uteri have been first, in a woman, aged 47, who had once miscarried. Twelve she was suddenly seized with a uterus. These bleedings occurred, period of her admission: between the or free from an aqueous discharge. polypus was found to protrude through ten days after her admission, it was double canula. Three days afterwards, away, and she did well.

case, the patient was 40 years of age, was and was delivered of a still-born seven months' afterwards. On examination, the polypus have firmly adhered to the roof of the vagina; nly, that it was utterly impossible to separate, or to allow of the passing a ligature around the thing, therefore, was attempted, as a radical cure. *Protrusion Uteri*.—In three of the cases of Protrusion of the uterus, the os was superficially ulcerated to some considerable extent, the inverted vagina appearing to have lost the character of mucous membrane, partaking more of the nature of cutaneous integument, and being of a pinkish colour. The wash, with mucilage and opium, was applied, to heal the ulcerations. Afterwards, the parts were returned, and put in situ, by a pessary.

Prolapsus Uteri.—Here the constitutional symptoms were far more severe than in the cases of Protrusion, although in the three cases of the latter there was ulceration. Astringent injections, the lot. alum. c., lot. arg. nit., lot. ferri sulph. were employed, to excite the contraction of the vagina. Pessaries of various kinds were adapted to the several cases.

Prolapsus Vaginae.—This displacement was occasioned by the patient's assuming the erect position too soon after a very difficult labour. There was great irritability of the vagina, with leucorrhœa. The only astringent injection that could be borne was the lot. arg. nit.; and the only artificial support, a piece of sponge.

Puerperal Convulsions.—Two cases of puerperal convulsions were admitted, both occurring during labour; one, in

a patient completely anæmiated from poverty and starvation; the other, in a remarkably stout plethoric Irish-woman, 19 years of age, and unmarried. The former was treated with stimulants, tonics, nutritious diet, and evaporating lotions to the head; while in the latter case, the strictest antiphlogistic remedies were employed. Both cases terminated successfully.

Tumor Abdominis.—This patient, on her admission into the Hospital, was reported to have “an abdominal tumor attached to the uterus, probably malignant.” By minute and careful examination, it was found to be external to the abdominal cavity, but posterior to the abdominal muscles. After some time, fluctuation became distinct; and she was transferred to the care of the surgeon, who opened the swelling, and gave exit to a large quantity of pus.

Tumor Meatūs Urinarii.—One case was admitted, in which, growing from the orifice of the meatus urinarius, there was a small vascular tumor, giving rise to great pain in micturition, and bleeding on the slightest touch: nitrate of silver, daily applied, effected its removal.

Tumor Ovarii.—Two of these cases occurred on the left, and two on the right side. Three of the patients were single women; and the fourth, although married, was separated from her husband. The iodine ointment, applied externally, and the internal exhibition of the julep. iodinii c., was the treatment employed. If any unpleasant symptoms were occasioned, as vertigo, heat in the throat, or fulness in the epigastrium, the patient was ordered to take the carbonate of magnesia; and, temporarily, to discontinue the medicine. Although these measures were not successful in removing the disease, still they seemed to render it stationary.

Tumor Uteri.—This patient was forty-one years of age, unmarried, and had generally menstruated regularly. There was a hard tumor above the pubes, extending upwards to the right side, as high as the umbilicus. Internal examination detected it, growing from the fundus. At the time of menstruation the tumor became larger and painful. She was ordered to apply iodine ointment, and to take the julep. iodinii c. three times a day. She persevered for weeks, although without diminishing the uterine tumor;

still, to the very great improvement of her constitutional powers.

Vesico-Vaginal Fistula.—Two cases have been admitted; both the result of protracted labours, in which perforation was resorted to. In one, the aperture admitted the joint of the fore-finger; in the other, the opening was smaller; and the patient was benefited by allowing a catheter to remain in the bladder, as well as by the daily use of the injection of the liquor calcis and opium.

RETURN OF OBSTETRIC OUT-PATIENTS WHO HAVE ATTENDED AT
GUY'S HOSPITAL FROM NOV. 30, 1835, TO OCT. 1, 1836.

| | | | |
|-------------------------------------|----|------------------------------------|-----|
| Abortio - - - - - | 7 | Over Lactation - - - - - | 14 |
| Amenorrhœa - - - - - | 30 | Pendulous Abdomen - - - - - | 1 |
| Anæmia - - - - - | 11 | Phlegmasia dolens - - - - - | 1 |
| Carcinoma Uteri - - - - - | 22 | Polypus Uteri - - - - - | 1 |
| Vaginæ - - - - - | 1 | Pregnancy - - - - - | 12 |
| Catarrhus Uteri - - - - - | 1 | Procidentia Uteri - - - - - | 17 |
| Chlorosis - - - - - | 17 | Prolapsus Uteri - - - - - | 32 |
| Climacteric Disease - - - - - | 20 | Vesicæ - - - - - | 2 |
| Contractio Vaginæ - - - - - | 1 | Prurigo - - - - - | 6 |
| Diseases of Pregnancy - - - - - | 14 | Relaxation of the Pelvic Joints, 2 | |
| Gonorrhœa, with ditto - - - - - | 4 | Retroversio Uteri - - - - - | 1 |
| Hydatids of the Uterus - - - - - | 1 | Syphilis, with Pregnancy - - - - - | 8 |
| Hydrops Ovarii - - - - - | 8 | Tænia, with Pregnancy - - - - - | 1 |
| Hysteria - - - - - | 27 | Tumor Ovarii - - - - - | 11 |
| Indurat. Oris Cervicisque Uteri, 13 | | Vaginæ - - - - - | 1 |
| Inflam. Oris Cervicisque Uteri, 5 | | Uteri - - - - - | 3 |
| Mammæ - - - - - | 2 | Tympanites - - - - - | 1 |
| Irritable Uterus - - - - - | 2 | Inflammatio Vaginæ - - - - - | 2 |
| Leucorrhœa - - - - - | 78 | Vesico-Vaginal Fistula - - - - - | 1 |
| Menorrhagia - - - - - | 26 | | |
| | | Total - - - - - | 402 |

Of these 402 females, 316 were married women, 71 unmarried, and 15 were widows; 162 women married under 21 years of age, 169 above that age. The products of these marriages were 1390 children; of whom, 671 were boys, and 719 girls: 156 women had miscarried, the collective total of their abortions being 343.

130 of these women are registered as being of light complexion; and 272, as being dark.

Amenorrhœa.—These cases were 30 in number: 12 were of light, and 18 of dark complexion. Their individual ages were as follows:

| 2 of the age of 15 years. | | 1 of the age of 22 years. | |
|---------------------------|----|---------------------------|----|
| 8 | 16 | 2 | 24 |
| 1 | 17 | 2 | 25 |
| 4 | 18 | 5 | 28 |
| 3 | 19 | 1 | 29 |
| 4 | 21 | | |

Carcinoma Uteri.—These cases were in number, 22: all occurred in married women: 7 were of light complexion, and 15 dark. The particulars of their cases were as follows:

| Age of Female. | Age when Married. | Number of Children. | | Miscarriages. |
|-------------------|----------------------|---------------------|--------|---------------|
| | | Boys. | Girls. | |
| 31 | 29 | 0 | 0 | 0 |
| 32 | 15 | 2 | 1 | 3 |
| 33 | 20 | 1 | 7 | 0 |
| 34 | 20 | 2 | 2 | 1 |
| 34 | 19 | 1 | 0 | 0 |
| 36 | 15 | 1 | 5 | 1 |
| 36 | 16 | 2 | 6 | 1 |
| 38 | 24 | 4 | 3 | 0 |
| 40 | 16 | 4 | 1 | 0 |
| 40 | 16 | 1 | 5 | 0 |
| 43 | 20 | 6 | 6 | 3 |
| 44 | 30 | 4 | 1 | 1 |
| 45 | 20 | 4 | 3 | 4 |
| 48 | 24 | 5 | 3 | 0 |
| 50 | 20 | 5 | 2 | 2 |
| 54 | 23 | 5 | 5 | 3 |
| 55 | 24 | 1 | 0 | 0 |
| 56 | 26 | 6 | 2 | 0 |
| 56 | 27 | 6 | 2 | 1 |
| 58 | 15 | 5 | 9 | 7 |
| 63 | 55 | 0 | 0 | 0 |
| 67 | 20 | 4 | 8 | 2 |

Carcinoma Vagina.—This case occurred in a female aged 41: she had married at 20, and had borne 12 children: it is worthy of notice, from the inguinal glands on both sides being affected with scirrhus.

Leucorrhœa.—The cases of Leucorrhœa are no less than 78. Four of them only were single women: the remaining 74 were married. Of these, 52 were married before the age of 21, and 22 not till after that period. No less than 30 of these women had suffered from miscarriages. 36 are reported as being of light complexion, and 42 of dark.

Menorrhagia.—The cases of Menorrhagia are 26 in number. 22 were married, and but 4 single. 14 were married before the age of 21, and 8 after that period. 10 of these women are stated to have miscarried. Of the 26, 10 are reported as being of light complexion, and 16 dark.

Over-Lactation.—The cases of Over-Lactation may be represented by the following table:

| Age. | Age when Married. | Complexion. | No. of Children. | No. of Miscarriages. |
|------|----------------------|-------------|---------------------|-------------------------|
| 23 | 20 | D | 2 | 0 |
| 33 | 21 | D | 4 | 1 |
| 41 | 23 | D | 10 | 12 |
| 34 | 22 | D | 4 | 0 |
| 20 | 16 | L | 2 | 0 |
| 29 | 19 | D | 5 | 0 |
| 41 | 19 | L | 7 | 3 |
| 27 | 24 | D | 2 | 0 |
| 28 | 20 | D | 5 | 2 |
| 43 | 26 | D | 6 | 4 |
| 29 | 18 | L | 6 | 6 |
| 30 | 22 | L | 6 | 1 |
| 27 | 15 | D | 6 | 1 |
| 30 | 26 | L | 3 | 0 |

Inflammatio Vaginæ.—The cases of this disease occurred in the persons of two young women; one aged 19, the other 20: one had been married two months, the other ten weeks: in both, the vagina was small; and in both cases, the husband was a half-bred Æthiopian.

STATISTICAL ACCOUNT OF GUY'S HOSPITAL LYING-IN CHARITY,
ESTABLISHED OCT. 1833.

From Oct. 1835, to Oct. 1836,

766 women have applied for Letters at the Lying-in Charity of Guy's Hospital.

Of these, 557 were English women

| | | | |
|-----|----|--------|----|
| 10 | .. | Welch | .. |
| 192 | .. | Irish | .. |
| 6 | .. | Scotch | .. |
| 1 | .. | German | .. |

Total . 766

The ages of these women were as follows:

| Years | | Years | | Years | |
|-------|---------|-------|---------|------------|---------|
| 2 | 17 | 59 | 28 | 16 | 39 |
| 7 | 18 | 38 | 29 | 21 | 40 |
| 15 | 19 | 73 | 30 | 4 | 41 |
| 19 | 20 | 21 | 31 | 9 | 42 |
| 28 | 21 | 36 | 32 | 2 | 43 |
| 39 | 22 | 28 | 33 | 1 | 44 |
| 50 | 23 | 22 | 34 | 2 | 45 |
| 36 | 24 | 30 | 35 | 1 | 46 |
| 43 | 25 | 34 | 36 | 1 | 49 |
| 42 | 26 | 16 | 37 | | |
| 49 | 27 | 22 | 38 | 766 Total. | |

Of these 766 females,

| Years | | Years | |
|----------------------------|----|-----------------------------|----|
| 1 married at the age of 14 | | 23 married at the age of 27 | |
| 14 | .. | 15 | .. |
| 37 | .. | 16 | .. |
| 42 | .. | 17 | .. |
| 79 | .. | 18 | .. |
| 102 | .. | 19 | .. |
| 93 | .. | 20 | .. |
| 80 | .. | 21 | .. |
| 73 | .. | 22 | .. |
| 50 | .. | 23 | .. |
| 44 | .. | 24 | .. |
| 50 | .. | 25 | .. |
| 29 | .. | 26 | .. |
| | | 766 Total. | |

Of these women—123 were first pregnancies: the remaining 643 had given birth to 2460 children. 2327 of these were born alive, and 133 were still-born.

Of the 2327 children born alive, 1219 were males, and 1117 females. Of the 133 still-born, 90 were males, and 43 females. 194 of these females had miscarried, and the amount of their abortions was 326.

Of the 766 females, 417 are reported as being of dark, and 349 of light complexion.

From Oct. 1, 1835, to Oct. 1, 1836, 629 women have been attended by the Pupils belonging to the Obstetric Class of Guy's Hospital.

Of these 629 cases, there were,

Cases of natural labour:

| | |
|---------------------------|------|
| Vertex presentation | 569 |
| Face ditto | 2 |
| | —571 |

Cases of premature labour 8

Cases of protracted labour:

| | |
|--------------------------------|-----|
| Delivered with forceps | 2 |
| vectis | 2 |
| perforator..... | 1 |
| by action of ergot | 2 |
| | — 7 |

Cases of preternatural labour:

| | |
|---------------------------|------|
| Breech presentation | 10 |
| Foot ditto | 1 |
| Arm ditto | 1 |
| Ditto with funis | 1 |
| Funis | 3 |
| | — 16 |

Cases of complex labour:

| | |
|------------------------------|------|
| Twins | 4 |
| Placental presentation | 2 |
| Retained placenta | 8 |
| Puerperal convulsions | 2 |
| Epileptic mania | 1 |
| | — 17 |

Flooding labour 7

Impracticable labour 1

Cases of mistaken pregnancy 1

Hydatids of the uterus 1

Total 629

Patients delivered from Oct. 1, 1833 to Oct. 1, 1835 649

Total attended by the Charity 1278

| | | Males | Females |
|-------------------------|-------------|-------|---------|
| Children born alive.... | 596 of whom | 316 | 280 |
| still-born..... | 34 .. | 18 | 16 |
| | <hr/> | <hr/> | <hr/> |
| | 630 | 334 | 296 |

Of the 34 children still-born,

9 were vertex presentations,
 8 . . premature labours,
 8 . . nates presentations,
 1 . . foot ditto,
 3 . . funis ditto,
 1 . . ditto ditto, with both arms,
 2 . . placental ditto,
 1 was delivered by forceps, ditto,
 1 ditto perforator,

Total, 34

Of the 2 face presentations,

1 was of 14 hours' duration,
 1 . . 12 ..

Of the 10 breech presentations,

2 of the children were born alive; and
 8 still born,

10

Of the 4 twin cases,

In 2, both children were males;

1 females; and in

1, one was a male, the other a female.

In 3 of the 4 cases, the vertex presented in both children. In the fourth, the first birth was a vertex; the second, a breech presentation. In one of the twin cases, the first child was born while the mother was in the erect posture; and the funis was lacerated at about the same distance from the umbilicus where it is usually divided. This accident has happened in 3 other cases, during the past twelve months; and in all, the funis has been lacerated at about the usual distance: in neither has there been any hæmorrhage; and in all, the children have been born alive.

Of these 627 women,

104 were 1st confinement,

99 .. 2d ..

70 .. 3d ..

81 .. 4th ..

89 .. 5th ..

65 .. 6th ..

51 .. 7th ..

20 .. 8th ..

18 were 9th confinement,

16 .. 10th ..

6 .. 11th ..

3 .. 12th ..

3 .. 13th ..

1 .. 14th ..

1 .. 16th ..

627.... Total

47 Cases occurred in the month of January,

54 February,

58 March,

51 April,

63 May,

52 June,

42 July,

46 August,

49 September,

52 October,

53 November,

60 December,

Total, 627

Six deaths have occurred during the past year. One in the person of Susan S——; who, ten days after her confinement, was seized with symptoms of peritoneal inflammation, but obstinately refused to be bled, or to submit to those measures which were prescribed: the consequence was, that she died in about 50 hours. (No post-mortem examination was allowed.)

The second fatal case occurred in the person of Mary M'C——; who had the placenta retained, from an hour-glass contraction of the uterus. This was removed by Mr. Lever. Thirty-six hours after delivery, symptoms of inflammation made their appearance, and were treated by venesection, calomel, antimony, and opium, with the best possible results; but they again recurred with increased violence the day following, from her having indulged in copious libations of porter. In spite of all entreaties, she

obstinately refused to take any more medicine; and died on the seventh day after her confinement. (No post-mortem examination allowed.)

The third case was that of Mary G——. She had previously borne four children; and her labour was described as perfectly natural. On the third day after her confinement, she was attacked with symptoms of puerperal fever, which were treated in the usual way—venesection, calomel and opium, antimony, &c., and with benefit: the improvement, however, was but temporary; her symptoms became more urgent; and she died within 60 hours from the attack. (No post-mortem examination could be obtained).

The fourth case occurred in the person of Hannah C——, aged 39; and who had previously borne eight children. (Vide Case 1, page 257.)

The fifth case was that of Caroline J——, who had borne six children. Her accoucheur, Mr. Hurst, reports her labour as tedious, and the presentation natural. On the eighth day after delivery, she was attacked with violent pain in the left iliac fossa, increased by pressure, and gradually extending over the abdomen. Bleeding, calomel and opium, antimony, &c., were resorted to, and with marked success; but the improvement was of a temporary character, as her symptoms became greatly aggravated, and terminated her life. On a post-mortem examination, the left broad ligament and ovary were occupied by cysts, containing fluids of different densities, as pus, bloody serum, &c. The peritoneum, throughout, was inflamed; and the uterine vessels were in an atheromatous condition.

The sixth death occurred in the person of Ann C——, whose case has been already published in the Reports. See Vol. I, page 320.

CASES OF OVARIAN DISEASES.

Reported by Mr. EDEN.*

CASE 1.

ELIZABETH J.—: Mary's Ward, No. 20: admitted Nov. 1831, under the care of Dr. Ashwell: aged 35: unmarried: subject to irregular catamenia for three years, recurring every fortnight, lasting a week, and accompanied by clots: ill 16 months.

On admission—ovarian dropsy: great pain in left iliac region, at commencement: tumor extends from pubis to ensiform cartilage, and into both iliac fossæ: fluctuation distinct: os, cervix, and body of uterus, healthy.

Treatment—Nov. 2: Julep. Pot. Nitrat. Ol. Ric. ʒss. p. r. n.—Dec. 18: Elaterii Ext. gr. ss. t. d. sing. dos. mist.

Progress—Nov. 8: abdomen fuller: parietes not thin enough to tap.—29th: Paracentesis: ten quarts of dark green slimy coagulable fluid.—Dec. 6: left her bed, and doing well.—13th: bandage applied.—18th: confined bowels.

Presented. Cyst slowly filling: to go into the country.

Dr. Ashwell saw the patient again about eighteen months afterwards; and the cyst, although tolerably full, was stationary, and had been so many months.

CASE 2.

Mary K.—: Mary's Ward, No. 12: admitted Aug. 30, 1832: re-admitted March 7, 1834: aged 25: married: emaciated, of dark complexion: miscarried four years ago: ill 18 months: was first attacked with pain in right ovary; since which, a gradual and universal enlargement.

At present, distinct fluctuation: cyst very thick at right inferior part: menses regular.

Treatment—Sept. 10: Paracentesis.—20th, ditto. Purgatives, diuretics, occasional opiates, and iodine.—Mar. 7, 1834: again tapped.

Progress—15 pints of fluid evacuated.—Sept. 25: again filling.—20th: 9 pints of fluid withdrawn, not coagulable by heat.—Oct. 30: going on well: cyst refilling slowly: urine abundant: great constipation throughout.—Dec. 6: Catamenia appeared after 14 weeks' cessation.—March 7, 1834: 9 pints of fluid withdrawn from one cyst only.

Presented Dec. 1832: again presented March 1834.

* These cases are arranged in this condensed form, that a comparison of similar symptoms and points may be easily made.

In April 1836, Dr. Ashwell saw this woman; and found the cyst only partially full, not requiring paracentesis.

CASE 3.

Jane B — : Mary's Ward, No. 19: admitted *Sept.* 28, 1832: aged 67: married; no children: very thin: swelling in both iliac regions for four years. One year and a half ago, remained in this ward 12 weeks; and after a long use of the iodine, she diminished nearly to her natural size, from having the appearance of being in the last month of pregnancy. Has since attended as out-patient.

On admission—abdomen painful, and greatly distended with very firm, fluctuating, ovarian cysts: abundant urine. For two years after the solid enlargement of the ovary commenced, there was no dropsical effusion: the fluctuation has only been evident during the last 24 months.

Treatment—Julep. Iodinii c̄ Tinct. ejusdem, et Pot. Hydriod. Casc. c̄ Sod.

Progress—Urine abundant throughout; the abdomen much diminished in size; giddiness in the head, &c., from iodine.

Since this period, the iodine has been more or less constantly administered; and the fluid in the cysts has been restrained from any great accumulation. The solid growth on the right side of the lower part of the abdomen is stationary, although still of great size.

CASE 4.

Caroline D — : Mary's Ward, No. 18: admitted *Sept.* 6, 1834, under the care of Dr. Ashwell: aged 27: fair: always healthy: married 10 years: 3 natural labours: regular but difficult menstruation: leucorrhœa: hæmoptysis, from straining 4 years ago, followed by swelling in right iliac region 12 months after last labour: swelling rapidly increased for 8 months; then remained stationary till present time: ill 4 years.

On admission—abdomen considerably distended; fluctuation distinct; pain in loins, hips, and left side, on deep inspiration; scanty urine; costive bowels. 10th: abdomen painful: now menstruating.

Treatment—M. M. c̄ M. S.—25th: paracentesis. — 26th: Tinct. Opii m. xxv.—28th: Cal. c̄ Opii et Liq. Opii sed.

Progress—*Sept.* 17th: distended to the utmost.—25th: only a few ounces of fluid withdrawn, from the compound nature of cysts. *Vespere*: an immense quantity of fluid escaped from the wound.—26th: better: abdomen distended with air.—28th: sudden rigors; tightness at scrob. cord.; vomiting of glairy fluid; burning sensation at umbilicus; collapse; cold surface; blue extremities; cold sweats;

little diarrhœa; but much abdominal tenderness.—9 P.M.: trocar wound gaping and inflamed: pulse like a thread: sinking.

Sept. 29th: death. No examination could be obtained.

CASE 5.

Mary M—: Mary's Ward, No. 12: admitted Feb. 28th, 1835, under the care of Dr. Ashwell: aged 57: widow: one child 3 years since: catamenia ceased 10 years ago: sallow; dark hair and eyes: had good health till within the last year; occasional leucorrhœa; severe pain in loins and flooding 6 months since (as much as a quart), which recurred every 3 or 4 weeks: constant draining in the intervals: ill 6 months.

On admission—a large tumor in the left side of the abdomen, extending as high as the ribs: it seems to be divided; the lower part being very hard, and smaller than the upper, which is more extensive, and very moveable: flooding; difficult micturition; costive bowels; os and cervix uteri healthy.

Treatment—Stimulants, opiates, purgatives, enemata: Croton Oil. Infus. Secal. C. o.i. Zinc. Sulph. et Alum. aa ʒi. pro injec.

Progress—Remarkable for the following circumstances:—flooding; leucorrhœa; tumor pressing on the rectum; occasional scybalous discharges, at which time the vomiting was alleviated; incontinence of urine; great pain in the growth; vomiting of apparently fecal matter. There can be little doubt that this was one of those malignant growths of the ovary so well described by Dr. Seymour. The fluctuation was not sufficiently distinct and extensive to allow of the opinion that it was produced by regular dropsical effusion into a scirrhus and indolent ovary. The rapidity of the progress, and the extreme suffering, confirm its malignancy.

No examination could be obtained.

CASE 6.

Mary S—: Mary's Ward, No. 15: admitted March 21, 1835, under the care of Dr. Ashwell: aged 26: married 6 years: 2 children; last 7 years ago: menstruated at 13: catamenia irregular, scanty, and painful; ceased since last child: good general health; occasional leucorrhœa: tumor probably commenced at right side, 3 years since; continued gradually to increase for 6 months, when it rapidly became large: ill 3 years.

On admission—the whole abdomen tense; umbilicus prominent; fluctuation evident; bowels open; tumor tender; and at the lower part the fluctuation obscure and indistinct.

Treatment—March 24: Vin. Colch. Tinct. Hyosc. Mist. Camph.

h. q. o. Leeches occasionally. — *May 9*: Pil. Hydr. Ext. Aloë. Ext. Hyosc.

Progress — Bowels irregular: much the same till *May 2*, when she left the Hospital. Re-admitted *May 25*: tumor very painful; rigors; burning heat in right side; vomiting of green fluid. Again left the Hospital, *June 17th*. Re-admitted *July 8*: larger; suffers from extreme tension; more fluid in abdomen. — *13th*: 3 pints of a glutinous tenacious fluid withdrawn. — *16th*: hot skin; thirst; anxious countenance; quick pulse: died in the night.

Inspection — Abdomen only, examined: tumor filled three-fourths of the cavity inferiorly, everywhere adherent to the parietes, and difficultly extracted. Peritoneum, with stomach, liver, spleen, &c., presented some traces of old inflammation, with abundant products of recent peritonitis. 3 or 4 pints of the mucus of the sac found in the serous cavity, mixed with puriform and partially fibrinous matter: some surfaces glued together by a plastic effusion: several parts much injected. Upper and larger half of the tumor formed by one immense cyst, with a dense, well-organized paries, one-fourth of an inch in thickness, tensely filled with a uniform, thick, turbid mucus: inferior part formed a plain wall to the great cyst, and seemed much more solid, although apparently forming a part of the main globular or ovoid tumor. Section shewed it consisted of cells, mostly of the size of an almond, close, and filled with mucus: thin walls, dense, fibrous, pale, rather vascular: many cells had apertures of communication, and the larger ones had others on their inner surface. One ovary, and broad ligament, thickened and expanded over the tumor: uterus enlarged and stretched. Second ovary probably first seat of disease. Bladder natural: liver pale, rather granular.

CASE 7.

Mary J —: Petersham Ward, No. 4: admitted *Sept. 13, 1836*, under the care of Dr. Ashwell: aged 30: single: short; thin; dark hair and eyes: born in Sussex: delicate health: last seven years in Boulogne, as nurse: catamenia appeared at 14: occasional amenorrhœa: menses occurred every fortnight, five months ago; ceased altogether for the last two months: ill eight months.

Her disease commenced with sudden pain in right inguinal region, followed by a hard, tender swelling, which rapidly increased, and passed to the opposite side: more rapid enlargement and anasarca for the last two months. Now, indistinct fluctuation; dulness on percussion; very distended veins; abdomen measures three feet six inches above the umbilicus; hardest in neighbourhood of umbilicus; difficult micturition; ~~regular bowels~~.

Treatment—Chiefly diuretics, occasional stimulants, with opiates.

Progress—Sept. 23: abdomen measures 3 feet 7 inches.—30th: 3 feet 7½ inches. (Edema extends to loins; impeded respiration.—Oct. 4: 3 feet 8 inches: vomiting of dark-green fluid: no nourishment taken.—10th: 3 feet 8½ inches.—14th: 3 feet 9 inches: in the upright posture all night; bowels confined for some days; legs very oedematous; calf measures 16½ inches.—15th: died at half-past 8 A.M., exhausted.—She seems to have suffered much from pressure, owing to the unyielding nature of the abdominal parietes, by which the stomach and thoracic viscera were greatly obstructed.

Inspection—Each lung the size of two fists, and crepitant; pleuræ healthy; right ventricle distended, and valve very imperfect; copious coagula; abdomen filled with a large tumor; left ovary adherent by a white oedematous vascular coat; peritoneal cavity limited by extensive adhesions; intestines contracted, and coated with old vascular, villous, serous membranes; ureters wide, thin, and distended with slightly coagulable urine; kidneys much enlarged, especially the left; coats easily separated; vertex studded with creamy spots, in different stages of softening; three or four inflammatory cells in the right kidney: uterus healthy; superior, anterior, and left portion of tumor formed of one cyst; its walls, less than one-sixth of an inch thick, and vascular, containing a coffee-coloured thick fluid, with copious sediment of soft purulent fibrin; firmer sheets coating many parts of the walls, adherent to a deeply ecchymosed lining membrane, which was ulcerating in some situations; posterior part and base of the tumor formed by masses of cysts, and containing fluid of different colours.

CASE 8.

Julia L.—: Petersham and Mary's Ward, No. 1: admitted Aug. 13, 1836: re-admitted Nov. 18, under the care of Dr. Ashwell: aged 51: Irishwoman; having lived in England 40 years: formerly stout; now emaciated; nine healthy labours; three miscarriages: good general health; catamenia re-appeared five months ago, after ten months' absence, of a menorrhagic character; succeeded by soreness and general swelling of abdomen; ill five months.

The tumor commenced in the right side, without being perceived: increased: she went into St. Thomas's Hospital for two months, and was admitted into Mary's Ward this day. Right side of abdomen more distended than the left; and occupied by a hardened mass, which seems to rise out of the pelvis as high as the ribs: the whole of the left side is tense, and fluctuates; occasional pain and dyspnoea; much flatulence, and tympanites; appetite good; secretions natural.

Treatment — 13th: Julep. Pot. Nit. t. d. Pil. Papav. c Conii

gr. v. o. n.—24th: Ung. Iod. abdom. Pot. Hydr. gr. ij. Iod. gr. $\frac{1}{4}$. Infus. Junip. $\bar{3}$ ij. Tinct. Card. co. $\bar{3}$ i. t. d.—Sept. 1: Acet. Scill. $\bar{3}$ iv. Sod. Carb. q. s. ad saturat. Sumat Coch. ij. amp. b. d.—9th: Jul. Am. t. d. Fetus Papav. p. r. n. Soda Water. Emp. Sinap. scrob. cord.

Progress—27th: abdomen measures 3 feet 7 $\frac{1}{2}$ inches.—Sept. 1: 3 feet 8 $\frac{3}{4}$ inches: urine scanty.—9th: 3 feet 10 $\frac{1}{2}$ inches: more painful; more emaciated; respiration more difficult.—11th: anasarca: upright posture all night: at 7 P.M. the trocar passed two inches below the umbilicus: 10 quarts of thick, glutinous, adhesive, deep straw-coloured fluid withdrawn: hard tumor on the right side then felt distinctly; it extends towards the mesial line, and upwards, into the right hypochondrium.—16th: cyst re-filling.—19th: 3 feet 2 $\frac{1}{2}$ inches.—Oct. 4: 3 feet 5 $\frac{1}{2}$ inches.—13th: 3 feet 7 $\frac{1}{4}$ inches.—Nov. 18: 4 feet: legs œdematous: considerable dyspnœa: veins enlarged.—22d: dyspnœa very severe during the night.

Presented.

CASE 9.

Hannah H——: Petersham Ward, No. 4: admitted Oct. 19, 1836, under the care of Dr. Ashwell: aged 39: single: menstruation regular till within three years; when she caught cold, the discharge became deficient, and her legs swelled: it appeared three months ago: she is somewhat emaciated.

She said, on her admission, she had no recollection of the precise spot where the disease commenced: abdomen measures 3 feet 2 $\frac{3}{4}$ inches an inch below the umbilicus: it is uniform, slightly projects in the left hypogastrium; feels like an impregnated uterus: very little fluctuation, and that posteriorly: left leg œdematous: confined bowels.

Treatment — M. M. \bar{c} M. S. b. d. — 24th: Acet. Scill. \bar{c} Sod. subcarb. — Nov. 1: Cal. \bar{c} Col. gr. x. alt. noct. — 7th: Quin. Sulph. gr. ij. Ext. Elaterii gr. $\frac{1}{4}$. Ext. Papav. gr. iij. t. d. — 15th: Infus. Ros. \bar{c} Quin. Sulph. gr. iij. t. d.

Progress—Nov. 7: much the same.—15th: the elaterium has produced decided benefit: it is only taken occasionally, and causes headache, purging, and sickness: abdomen measures 1 $\frac{1}{2}$ inch less; and fluctuation slightly increased.—29th: a diminution of 3 $\frac{1}{4}$ inches: urine in good quantity: no œdema.

Nov. 10: Presented.

CASE 10.

Phœbe P——: Martha's Ward, No. 6: admitted June 30, 1832, under the care of Dr. Ashwell: aged 23: an inhabitant of Deal:

previous to admission, amenorrhœa for last twelve months; and impaired general health for about half that time: ill 15 years.

Very little inconvenience till within the last year; since which, the tumor has grown rapidly: fluctuation perceived six or eight weeks since: prior to this time, the growth has been extremely solid, without the slightest evidence of fluid.

Treatment—Iodine, internally and externally, and in several forms, continued from the date of admission, till Dec. 21 of the same year; when it was permanently omitted; and leeches, blisters, refrigerants, and aperients, occasionally resorted to.

Progress—More influence exerted over the urinary organs by the iodine than by nitre julep.: this, however, ceased after nearly six months; and the iodine then seems to have occasioned head symptoms: the abdomen, however, had only increased two inches in size, and her health was not more impaired.

Presented, in much the same condition, Jan. 18, 1833.

This patient died from cholera within a year after her discharge from the Hospital. Up to the period of her disease, the tumor had been stationary in size; nor had the softening or fluctuation become more distinct.

CASE 11.

Reported by Dr. ASHWELL.

Mrs. —, aged 35, under the care of Mr. Rance and myself: married for 16 years, and has borne five children: of light and strumous aspect: has always been delicate, but not sickly: in her last pregnancy she had ovarian dropsy; and was tapped six weeks after her labour: 20 pints of yellow, viscid, and albuminous fluid were withdrawn: she recovered, and became again pregnant: ill 2 years.

Ovarian dropsy, and pregnancy of six months: few of the usual concomitants of gestation: she is large and unwieldy: pulse quick, but not feeble; embarrassed breathing, cough, and muco-purulent expectoration; œdema of legs and ankles; scanty and high-coloured urine; debility, and a relaxed condition of the bowels.

Treatment—In June 1836, diuretics, tonics, and alterative mercurials: nutritious diet, mild malt liquor, and carriage exercise.—In August, as there was no marked aggravation of symptoms, the plan was not varied.—October 1, 1836: delivered of a healthy boy; and recovery tolerably good.—Till December 11th, paracentesis was avoided, champagne and good diet having been largely employed; but at this period, the distention was so painful, the pulse so quick and irritable, and there was such entire sleeplessness, that she begged to be tapped: she measured, round the umbilicus, 4 feet 7 inches: only 2 pints of viscid, dark-coloured, albuminous fluid

could be obtained, as, unfortunately, only a small and distinct cyst was punctured.—*Dec. 16th*: paracentesis, and 3 pints withdrawn.—*Dec. 21st*: again tapped; this time in the linea seminularis; and nearly 22 pints of the same kind of fluid were evacuated.

In a few days afterwards, she sunk, exhausted by the disease. (No inspection could be obtained.)

CASE 12.—ASCITES.

Ann W—: Petersham Ward, No. 7: admitted *Oct. 19, 1836*, under the care of Dr. Ashwell: aged 38: twice married; one child: always healthy; catamenia absent since June last: inflammation of the lungs last June, for which she was rather largely depleted: after recovery, experienced pricking sensations over the abdomen, for which she went to the Marine Hospital at Woolwich: ill 8 months.

On admission—ascites; abdomen flabby; tender upon pressure in right hypogastrium and epigastrium; parietes thin; undulation distinct; bowels costive; painful micturition; abdomen measures 2 feet 10½ inches, its greatest diameter, an inch above the umbilicus, uniform; considerable œdema of the legs; abdomen very tympanitic.

Treatment—Julep. Iodin. t. d. Ung. Iodin. abdom.—*24th*: Assafoetid. ʒi. ex Aq. calid. o. i. o. n. pro injec.—*27th*: Acet. Scill. c̄ Sod. Carb.—*Nov. 1*: Iodin. gr. ½. Pot. Hydr. gr. ij. Infus. Junip. ʒij. t. d.—*11th*: Elat. Ext. gr. ½ ex Infus. Junip. t. d.—*13th*: Fiant puncturæ. Pil. Ant. Opiat. fort. c̄ Hydr. submur. gr. ij. quartis horis. Hirud. xxiv. scrob. cord.—*14th*: Infus. Serpent. c̄ Ammon. subcarb. gr. x. quartis horis.

Progress—*Oct. 29*: abdomen measures 3 feet.—*Nov. 7*: pain in back and loins: sickness.—*13th*: exposed to wet and cold in the water-closet: erysipelas commenced under the left side of the lower jaw; cerebral disturbance; tongue dry and black; severe pain in the abdomen.—*15th*: erysipelas extended to the whole of the left side of the face; five relaxed motions; abdomen measures 3 feet 3 inches; more dull on percussion.—*16th*: erysipelas extended to the right eye; skin of the nose suppurating; pulse very feeble, 120: takes no nourishment; died at midnight.

Inspection—*Nov. 17, 1 P.M.*: peritoneum of parietes of a pinkish hue: serous surface dull, and a delicate layer of coloured fibrin adherent, but separable, the peritoneum beneath being pale and thin, and also separable; sediment of ascitic fluid plentiful, flocculent, and grainy, with large shreddy masses of pus-coloured fibrin; liver nodular, and unequally coated with thickened and dense old membranes; kidneys weak, very pale and flabby, and easily lacerated; cortical texture minutely granular; rather a thick layer adherent to

the proper tunic, which seemed thickened; no urine; bladder natural: os uteri thick, solid, and seated with mucus; ovaries much reduced: rugous dense; jejunum œdematous; ilium and colon covered with minute spots.

OBSERVATIONS.

These cases are presented in a condensed form; because many of the circumstances, although deeply interesting, are similar in the different patients; and thus much repetition in the printing, and valuable time in the perusal, are spared. I have no new or specific treatment to recommend; for it is, perhaps, in these maladies, to be hoped, rather than to be expected, that by throwing a number of them together, and placing prominently before professional men their probable causes, their varied progress, their distressing symptoms, and their termination, that some better means of cure may be discovered. It is impossible not to contrast our little remedial controul over ovarian dropsy with the good which is so frequently obtained from medicine in dropsy of the abdomen; nor can we hesitate to attribute this marked difference to the absorbent function of the peritoneum—a power with which, if at all, the adventitious and serous ovarian cyst is only slightly endowed: for while it can no longer be doubted, after the demonstration of Dr. Hodgkin, that these lining membranes of the diseased ovary possess arteries and veins, it has never yet been shewn that absorbents exist in their structure. Absorption, I am aware, is not necessarily limited to peculiar vessels of this kind; but still, the pathology of these ovarian growths, and the effect of remedies upon them, tend to the conviction, that absorption rarely occurs in their cavities. That the internal surfaces of these cysts secrete, there can be no doubt; and in this they resemble the peritoneum: but here the similarity terminates; for while the absorbent power of the latter membrane is undeniable, the same function is only partially and doubtfully performed by the adventitious serous membranes. Corroborative illustrations are not rare. In the First Number of the Reports (page 41), Dr. Addison adduces an instance of the accidental rupture of an ovarian cyst, of several years standing, where the fluid escaped into the

peritoneal sac, and, under mercurial treatment, was entirely absorbed.

Hence, too, in the employment of mercury, iodine, and diuretics in dropsy of the ovary, we scarcely hope to accomplish more than such an increase of the healthy function of the kidney, as may enable us, as it were, by counter-secretion, to restrain the morbid ovarian effusion. It will not, therefore, be difficult to understand how it is, that we so frequently fail in the treatment of these common and painful maladies.

The statistics of these cases are instructive. In nine out of the twelve patients, there was deranged menstruation. Eight were, or had been married; four were single. Two had not been mothers; and the remaining six had produced only twenty-two children; fifteen of the number having been borne by two women;—facts not altogether unimportant, where the ovaries are structurally diseased.

The progress of ovarian dropsy is extremely uncertain, and the effect of treatment is not less so. Occasionally, the disease advances by almost imperceptible degrees, and, for years, is scarcely at all regarded: suddenly, however, and without any appreciable cause, the malady not unfrequently displays great morbid activity, and paracentesis is performed to obtain transient and slight relief. All remedies, excepting the extirpation of the diseased viscus, participate in this general inefficiency; and we cannot but regret that the curative means are so few and so feeble. Negative treatment, or, in other words, an attention to the general health, avoiding, as much as possible, constitutional excitement and ovarian irritation, promise most favourably for the patient. The cases adduced, and many others, sufficiently attest the powerlessness of medicine; and as to the radical cure, it is too truly hazardous, to be more than very rarely even thought of.

It is true, that many patients pass through a tolerably long and comfortable life with a large ovarian dropsy; and more might enjoy this immunity from suffering, if marriage and parturition were avoided, and if they could be induced rigidly to practise self-denial and abstinence.

The following case I saw with Mr. Pilcher, the Lecturer

at the Webb-street School; and, as it demonstrates the inefficiency of the bougie and injection, the nearest approaches to extirpation, I shall very briefly narrate it:—

Mrs. S——, aged 36, the mother of several children, had suffered, for some years, from ovarian dropsy. Mr. Pilcher had already tapped her six or seven times; and on one occasion, after the escape of a large quantity of fluid, an elastic catheter or bougie had been left in the cyst for several days, without producing the slightest inflammation. Mrs. S—— was very anxious that something more radical and decided should be undertaken for her relief; and, after the next evacuation of the cyst, it was injected by an enema pump, with many pints of a weak solution of the sulphate of zinc: the inflammatory symptoms were alarmingly severe, and her recovery was for some days doubtful. Eventually, she rallied; and in a few weeks, to relieve excessive tension, six or eight ounces were drawn off. The fluid, on this occasion, was not albuminous, as formerly, but fetid pus. In a few more weeks, paracentesis was again necessary; and we were a little curious as to what might be the character of the contents of the cyst. True pus, slightly fetid, was evacuated, to the amount of eight pints, not more than a third of the quantity formerly withdrawn. Tapping was frequently afterwards necessary; and in about twelve months she died, completely exhausted by the disease.

The cyst is in the Museum of the Webb-street School.

LARGE HARD TUMOR OF THE UTERUS;

WITH POST-MORTEM APPEARANCES, AND PLATE.

Reported by Dr. ASHWELL.

Mrs. —, aged 44, was married at 36 years of age, but has never been pregnant. She enjoyed excellent health, and was remarkably active up to her fortieth year. At that time (1827) she first discovered a tumor in the lower part of the abdomen, an inch or two above the symphysis pubis, which was supposed to be uterine. For two or three years the growth slowly increased, without disturbing her health, or causing any marked inconvenience. In November 1831, I was first requested to visit her; and, on examination, I found a tumor in the abdomen, about the bulk of the uterus.

in the sixth month of gestation. It had mounted nearly to the umbilicus; and appeared to consist of one large, and a second smaller growth; the latter being placed low down, near to the left groin; while the former, remarkably bulky, occupied the middle and right lateral region of the abdomen. Both were hard, slightly moveable, and not painful to the touch. The increase of size had been especially manifest only for a few months; and was especially attributed to the pressure and excitement of tightly bandaging the abdomen, a practice professionally recommended.

The functions of digestion and nutrition were somewhat impaired; but although there was loss of flesh, there was no decided emaciation. The bowels were constipated; and senna cake was frequently taken, to stimulate the intestinal canal, whose functions were mechanically interrupted. The thighs and the legs, but especially the ankles, were œdematous; the respiration was occasionally embarrassed; and, on exertion, there was palpitation of the heart. The urine was scanty; the pulse 95 to 100; and there was an unhealthy and partially jaundiced hue about the skin. Menstruation (the patient being nearly 44), was regular and healthy.

By an internal examination, it was ascertained that the cervix uteri was large, and very hard: the anterior lip of the os was knotted, slightly fissured, and painful when touched; the whole internal surface of the vagina was relaxed, and moist from muco-purulent and aqueous discharge.

The internal and external use of iodine was recommended: four or five drops of the tincture were taken twice or three times daily; and some of the ointment (about as much as a very small nutmeg) was rubbed every night on the os and cervix, as well as over the growths externally. The bandage was entirely laid aside: generous diet, moderate exercise, and the avoidance of mental and sexual excitement and fatigue, were strictly enjoined. Enemata of warm water were to be used occasionally, as auxiliary to mild aperients.

It would be uninteresting and tedious to detail minutely the various symptoms and progress of the malady. I may, however, remark, that, after the iodine had been used for six months, with occasional interruptions, the tumors externally had ceased to grow; an opinion in which the

patient's friends fully concurred. Exact measurements had been taken prior to the employment of the remedy, and these were decisive on this point. The induration and bulk of the cervix were removed, and the fissures perfectly free from hardness and pain: there was, also, less leucorrhœal secretion: still, the iodine had seriously impaired her health, and she was painfully debilitated. She removed to the sea-side; iron and quinine were largely given; and her diet and alimentary canal were carefully attended to. In six months she returned home, in good health.

From the early part of 1832 till the autumn of 1835, the growth was stationary, and free from pain. At this latter period, without any apparent cause, it began again to increase; and distressing pain was produced, not only by the distention of the abdominal parietes, but by the pressure, distention, and traction of internal parts. Gradual yet considerable emaciation occurred; but there did not appear to be any marked inflammatory symptoms till about six or eight weeks prior to her death: nor was menstruation interrupted. From the combined effects of inflammation and distention, her later sufferings were extreme: for the tumor not only filled much of the abdomen, but so completely occupied the pelvis, that it projected far down into the vagina. The inflammatory pain had been principally felt a little below, under and to the left of the umbilicus; and cupping had afforded some relief. The locality of the inflammation is well seen in the annexed Plate. Unctuous applications, by relieving the stretching and extreme distention, anodyne injections, and suppositories, procured some mitigation of her sufferings. The patient expired about mid-day on the 20th Nov. 1836.

The post-mortem examination was made by Dr. Hodgkin, whose full and very accurate report I subjoin. The drawing by Canton will also illustrate the appearances described by Dr. Hodgkin.

"The body, generally, was emaciated: no œdema, discoloration, or other remarkable appearances, were noticed, except as connected with the size of the tumor. The abdomen, though so greatly enlarged, wanted the uniform distention of dropsy, or even of pregnancy. It was not symmetrical, as to its figure; or uniform, as to its resistance.

On the right side, on which it rose to the hypocondriac region, it was rather nodulous, and firmly resistant. On the left side, on which it did not rise quite so high, it was neither nodulous, nor so resistant, but felt almost as if the distention was caused by fluid. On turning back the parietes, which were much attenuated, they were found united, by feeble and recent adhesions, to the lower part of the tumor; but they were most considerable on the left side. The bond of union, which was remarkable, will be presently described. The omentum, which was much attenuated, had contracted a firm old adhesion to the tumor above, and to the right of the umbilicus. The tumor, at this part, was white or pale, and appeared superficially semi-cartilaginous; but there was a little recently effused blood coagulated, and some small collections of very soft cerebriform matter. The inferior portions of the tumor, especially on the left side, were of various shades of livid red and brown, very soft, and accompanied with considerable extravasation. The fundus of the uterus was raised out of the pelvis, as high as the superior spinous process of the ileum; and was situated about midway between it and the median line, but rather nearer to the former. The left Fallopian tube, and the ovary, which was large, broad, and flattened, were stretched over the tumor, directly to the left; whilst, on the right, the Fallopian tube and ovary, which were much more elongated than the left, were also stretched over the tumor, in a somewhat ascending direction, to the right. The Fallopian tube must have been eight or ten inches in length: the ovary was elongated, and flattened. The round ligament was likewise stretched over the tumor to the right; but it took first an horizontal, and then a descending direction, until it was widely separated from the Fallopian tube. At the upper and posterior part, the tumor appeared to have contracted few, if any adhesions, old or recent. The tumor, which was situated in the parietes of the uterus, will be described in the sequel. There was no appearance of any peritoneal affection, except recent adhesions about the anterior and lower part of the tumor and the omentum. The alimentary canal appeared to be healthy; but, although there did not seem to be any contraction or induration of the pylorus, the portion of the stomach immediately above it shewed some

tendency to be dilated into a pouch. The mesenteric glands were small, and appeared to be quite healthy. The liver also appeared to be healthy, but small. The spleen was rather large.

The character of the recent adhesions between the tumor and the parietes, the deposit in the omentum, and the structure of the tumor itself, deserve particular description.

On separating the recently-adhering parietes, it was evident that the material interposed between the two surfaces of peritoneum was not ordinary coagulable lymph, but a soft white cerebriform matter, somewhat like stationers' paste, intermixed with spots of extravasated blood of various sizes. On carefully separating further portions of the attached peritoneal surfaces, it became evident that the soft cerebriform matter was not irregularly effused upon the inflamed surface of the peritoneum, but that it was collected into circumscribed depositions of very various sizes, but having almost universally a rounded but very compressed form; the flatness evidently depending upon compression between the two opposed surfaces of serous membrane, and a circumscribed rounded figure, which seemed to depend on the cerebriform matter, not blending with the general secretion of the peritoneum, but rather remaining as a drop of oil would do upon a wetted surface. It likewise appeared, that on the surface there was an extremely tender pellicle; which rendered it possible to move the soft deposits without breaking them, although their form might be changed. A very slight force, however, produced rupture; when the contained material escaped, as a grumous amorphous mass. They might, in fact, be compared to little yolks of egg separated from the white, except that their form was more flattened, and the inclosing pellicle comparatively more tender. These little collections of cerebriform matter possessed different degrees of translucence. Some presented a uniform milkiness; others were spotted with points of extravasated blood; and in some the spot of extravasated blood formed a defined rounded body, which appeared just as distinct from the white cerebriform matter as this did from the surrounding texture or secretion. These appearances were most beautifully seen on the

omentum, which was thin and delicate, and, with the exception of these appearances, and the old adhesions before mentioned, retained a perfectly healthy character. On the omentum, some of these little circumscribed deposits of cerebriform matter might be seen scarcely so large as pins' heads, whilst others were nearly as large as a shilling.* The smaller deposits appeared to take their origin very near, or in the course of the minute blood-vessels. A little below, under, and to the left of the umbilicus, where the recent inflammation had been most intense, the parietes of the cyst were so softened, that, in some parts, the defined limits between the substance of the tumor and the productions of the serous surface were lost; the fingers passing into a mass, of the consistence of softened brain, and intermixed with extravasated blood. In removing the tumor from the body, some portions of this softened part of it were detached, partly by laceration, and partly by the knife. The tumor weighed about twenty-five pounds. It was evidently lodged in the substance of the uterus; but its fundus and its angles, and the commencement of the Fallopian tubes, and the attachment of the round ligaments, though carried out of their natural situation to that already mentioned, did not appear to have undergone any distention or derangement of their relative position, as respects each other. The whole fundus was a little enlarged. A section was made through the tumor, so as to divide the fundus into two lateral portions: it was carried towards the os, but so as to leave the whole, or the greater part of the os, with the left-hand portion. This, which appeared to be the best section for showing the state of the uterus, left more than three-quarters of the entire bulk on the right side. As it passed through the hardest, and also the softest parts of the mass, it afforded views of the varieties of texture which it presented. It was evident that this extraordinary enlargement was occasioned by the formation of tubercles, having the cystiform arrangement developed in the substance of the parietes of the uterus. The greater part of it consisted of one very large, and several smaller tubercles, of scirrhus hardness, and of a nearly dead milk-white colour, developed

* See *Morbid Anatomy of the Serous Membranes*, by Dr. Hodgkin, Sect. xlii.

in the posterior and right lateral parts of the parietes. Within this mass of hard tubercles, but almost in contact with the internal surface of the uterus, was a mass, which appeared to be nearly spherical, about four inches in diameter, of a deep brick-red, but not uniform colour. It was of fleshy softness, and distinctly possessed the cystiform arrangement. The subordinate portions were more loosely connected among themselves than in other parts of the solid mass. The state of distention of the cavity of the uterus may be inferred from the situation of the fundus, which was seven or eight inches from the os. Its internal surface was extremely uneven and irregular, from the projection of numerous nodulous, but breaking-down fungoid tumors, of about the size of a chesnut or walnut. They were bathed with an offensive dark sanious fluid. Though the anterior parietes were also the seat of adventitious productions of a similar structure, their thickness was scarcely, in any part, increased to more than about two inches. There was a great variety in the consistence of the adventitious growths in this part. One well-defined tubercle, of the size of a cob-nut, was of a dead milk-white colour, and of scirrhus hardness: more had the softness of cerebriform matter, and were variously coloured by imperfect organization and extravasation; whilst some possessed the softness and transparency of gum or gelatinous cancer. Some of these, notwithstanding their great tenderness, distinctly exhibited the form of a reflected membrane, with extremely minute and delicate vascularity. The inflammation at the anterior and posterior part of the mass appeared to be connected with the breaking down of the adventitious structure, including those in the anterior parietes, those projecting in the interior of the uterus, and the large sanguineous mass occupying a part of the right side.

REMARKS.

The preceding case affords me the opportunity of expressing continued confidence in the efficacy of iodine. In a former Paper (vide Vol. I. p. 147), I have stated, "that in the walls of the uterus, which are not glandular, the iodine has generally accomplished only a certain amount of good: it has restrained the activity of the disease, confining its

bulk within the limits it had attained prior to its exhibition. I have watched some of these cases of large hard tumors of the uterus for two years, since the remedy has been discontinued; and, as yet, there has been no augmentation of the growth, no renewed activity of the morbid process."

Here, by the use of the iodine, three years, at least, were added to the life of the individual, with an almost entire exemption from the sufferings previously attendant on the malady: and, had it not been for the immense bulk and weight of the tumor (26 lb.), it is probable that a still further period would have elapsed, without the occurrence of that degree of constitutional irritation by which she was eventually destroyed. In the growth itself, the morbid changes were such as I have already described. There was softening, inflammation, and unhealthy suppuration; changes well portrayed in Mr. Canton's drawing. Nor can it excite surprise, that life should have been destroyed by such a complication of ills. I may perhaps be excused, if I urge the importance of deliberation, before the employment of the remedy. In cases, where, after remaining almost, perhaps entirely, stationary for months or years, the tumor has begun suddenly to grow, and the patient's health is not materially impaired, the external and internal use of the iodine may be strongly recommended; but in those unfortunate instances, where the growth has been long neglected, and where the constitutional powers are beginning to fail before the remedy has been suggested, its employment will be injudicious, the strength of the patient will be further impaired, and it is not unlikely that the fatal result may be accelerated. These cautionary observations are limited to the hard tumors of the walls of the uterus: they do not refer to similar deposits in the os and cervix.

I am glad to be able to allude to Case 7, p. 143, in Vol. I., as further confirming the truth of the preceding observations. The tumors of the walls, in that instance, were large and hard; and the iodine, after having been employed for six or seven months, had restored the os and cervix to a healthy condition, and had arrested the growth of the abdomino-uterine enlargements.

It is now five years since the remedy was left off; and, after a careful examination within these few days, I can still say, that the mouth and neck of the uterus are healthy, and that there is no augmentation of the uterine disease: she walks without inconvenience; and is active, cheerful, and healthy. Other cases are under treatment; and the results shall be accurately communicated.

FOUR CASES OF POLYPUS CURED BY LIGATURE:

Two or Three being Reported and Condensed by MR. HENRY OLDHAM.

CASE 1.

Elizabeth H——, aged 44, was admitted into Mary's Ward, in April 1833, under Dr. Ashwell. She is an unmarried woman, and has usually enjoyed good health. This was interfered with three years ago, by a profuse flow of the catamenia; succeeded by such irregularities in the performance of the function, as to induce the persuasion that it was about to cease.

These passive hæmorrhages were sometimes very copious; and not unfrequently a pint has been expelled, at one gush. The character of this discharge changed about two years since, and assumed the appearance of coffee-grounds; becoming also more irregular in its recurrence, and very offensive. This last peculiarity, however, was not constant: in the absence of a red discharge, there was one of a mucous kind.

She now complains of great lumbar pain, extending to the sacrum, with rigors, on the accession and going off of the sanguineous discharge. There is no bearing down, nor pain on micturition; but she occasionally feels a mechanical obstacle to the free exit of the urine. She experiences a sensation of fulness about the vagina, and a distressing sense of weakness on making any exertion. Her countenance and general surface are exsanguine; and though not absolutely emaciated, yet the flabby condition of her muscles indicates imperfect nutrition. The cerebral symptoms

consequent on hæmorrhage are present, and the legs and ankles are œdematous at night. Dr. Ashwell examined, and entered the following report:—

"I find a polypus attached to the fundus, about the size of a large hen's egg. The finger easily encircles its peduncle within the cavity of the uterine neck, and it extends half way down the vagina. Its structure is firm, and insensible to the scratch of a pin."

She was ordered to take tonics, and to maintain the recumbent posture; and in a few days, the polypus was noosed by ligature. The double canula was the instrument employed, furnished with a piece of whip-cord of suitable length and thickness. The patient was placed at the edge of the bed, in the usual obstetric position. The fore-finger of the left hand was passed over the enlarged portion of the polypus within the vagina, resting a little below the cervix. The canula was thus directed to the spot, and one of the tubes was carried round the polypus; and on regaining its fellow, was adjusted within the receiving tubes. The ligature thus applied was then tightened, and its free extremities twisted round the shoulders of the instrument. The patient did not complain of the slightest pain, but spoke of an obscure feeling of strangulation in the part. The ligature was daily tightened; and the vagina was occasionally washed out with warm water. The polypus was separated, and came away with the instrument on the eighth day after the operation, appearing much diminished in size.

From the time the ligature was applied, there was no further discharge. The patient daily improved; and she was shortly presented, cured.

CASE 2.

Jane J——, aged 47, a single woman, of slim make, whose aspect and sunken features conveyed the external symptoms of malignant disease, was admitted into the Hospital, under Dr. Ashwell, in August 1834.

Her health has generally been feeble; but, with the exception of several hysterical symptoms, it did not materially suffer until three years since: at this time, the catamenia,

which had hitherto flowed naturally, became very profuse, lasting 12 or 14 days, and attended by clots. A copious purulent and very fetid discharge succeeded this passive hæmorrhage, and alternated with the menstrual flow. With the exception of rather too profuse menstruation, she did not suffer from hæmorrhage during the growth of the polypus; but her present attenuated and very weakened state seems attributable to the purulent discharge, which continues unabated.

An examination was instituted by Dr. Ashwell, who reported:—

“I find the vagina completely filled up by an insensible pyriform body, which almost protrudes through the external labia. This growth is encircled by the os uteri; but the finger can pass between them, excepting at the posterior part of the interior of the cervix, where the polypus is attached; and here the os is attenuated.”

The bowels were regulated; and sulphate of quinine, in the compound infusion of roses, was administered. On the 27th of August, the polypus was tied: and when the ligature was tightened, the patient did not complain of pain. In the evening, there was some abdominal tenderness, which probably arose from a distended bladder. The catheter was passed, and an opiate administered. She experienced no further suffering: the ligature was tightened daily; and on the 5th of September, nine days from the operation, the polypus was cut through, and with some difficulty, owing to the smallness of the vagina, withdrawn. It is worthy of remark, that the discharge ceased after the polypus was tied, nor has it since recurred. Her general health rapidly improved; and she soon left the Hospital, cured.

CASE 3.

Mary-Anne W——, aged 35, the mother of three children, but now a widow, has been suffering the last two and a half years, from uterine hæmorrhage. This occurred, without any premonitory symptoms, in profusion; but has since been diminished in quantity, but constant. She is now the subject of anæmia; the surface being uniformly blanched; and her general health has been daily declining.

On examination, a polypus was discovered, just protruding through the os, insensible to pressure. It was probably attached to the body of the uterus, as the finger could be passed round the cervix.

The loss of blood, which this patient was daily sustaining, determined Dr. Ashwell to attempt to strangulate the polypus; but its very slight descent, and the unusual length of the vagina, frustrated the endeavour. On the evening of the same day, flooding occurred; the pulse was almost imperceptible at the wrist; the pupils contracted; and she appeared comatose. Active measures were employed to arrest the hæmorrhage; which was accomplished, by plugging the vagina. She gradually recovered from this attack: and a longer instrument having been procured, the polypus was tied on the 4th of October.

No further hæmorrhage occurred, nor did the patient experience any pain; and on the eighth (four days after the operation) the polypus was cut through. This woman regained her former health and spirits, and left the Hospital quite well.

CASE 4.

Georgiana W——, aged 34, was admitted, Oct. 23, 1834. She is a delicate strumous woman, and was delivered of a six-months' child ten months ago. For the last two years she has been supposed to labour under menorrhagia, and every variety of treatment has been employed without success. To arrest the hæmorrhage, she attended as an out-patient at the Hospital, and the *secale cornutum* was administered; but as the discharge continued, she was examined. A large polypoid growth was discovered, partly protruding into the vagina, but encircled by the os and cervix; the former of which was exceedingly attenuated. Scruple doses, repeated three times, of the *secale cornutum* were administered, with the hope of procuring a further protrusion of the polypus, and its release from the embrace of the os and cervix. This had the desired effect, and Dr. Ashwell tied it without difficulty. The catheter was passed for two days after the operation, which was not accompanied or succeeded by pain. Warm-water injections

were used during the separation of the polypus, which was accomplished in eight days' time. This patient recovered without a bad symptom.

REMARKS.

Of late, the opinion has been adopted by some eminent pathologists, that uterine polypi and hard or fibrous tumors of the uterus are nearly identical. I am disposed to believe that there are, occasionally, points of similarity, especially, between large, old, and condensed polypi and these tumors; but it is erroneous to view this similarity as at all complete, or universally existing.

In *structure*, there is rarely as much induration and closeness of texture in the polypus as in the fibrous or fleshy tumor: in the latter, there are generally to be found the white membranous lines transversing the tumor in every direction, and a hardness; forming together the diagnosis of scirrhus from other diseases. In the majority of polypi, with the exceptions stated above, there is a looseness, softness, and vascularity, clearly diagnostic of a different organization.

In *sensibility*, there is little resemblance between the two diseases; for while in the genuine uterine polypi, with scarcely an exception, there is an entire absence of sensation, the hard tumor is by no means bereft of this property. A needle may be pushed into the former growth without exciting pain, but not so in the fleshy tubercle. One of the best distinctive marks of a polypus, is certainly, its insensibility.

In *vascularity*, there is a wide difference. It is rare to meet with a hard tumor that bleeds; while it is certainly very uncommon to discover a polypus from which the hæmorrhage is not frequent, and sometimes large and alarming. In a late volume of the Medico-Chirurgical Transactions, Mr. Langstaff adduces an instance where a patient lost her life from the repeated bleedings of an undiscovered uterine polypus. Nor are such occurrences rare.

In *locality*, they generally differ widely. The hard tumor most frequently grows externally, seldom encroaching on the cavity of the uterus. Allowing, what is perhaps true,

that they have a common seat of origin, probably in the muscular tissue—while the tumor proceeds towards the walls, and, by its growth and bulk, mechanically interferes with the abdominal viscera—the polypus distends the mucous lining, and, whatever size it may attain, it continues to be invested by an increased growth of the same tissue. Thus, in the majority of tumors, the peritoneum, a serous membrane, will form the external tunic, while the polypus is entirely covered by mucous membrane.

The *morbid processes* attendant on their progress are not similar: the tumor, when it destroys life, which is not common, does so by irritation of the system generally, and by inflammation and ulceration of proximate organs; rarely by ulceration in its own structure. The polypus, on the contrary, if undiscovered or neglected, induces a fatal result, most commonly by hæmorrhage, from vessels pouring out blood from its surface; and occasionally, ulceration is present also.

The cases prefixed to these observations are not devoid of interest. In all, an examination had been neglected, till the symptoms were so urgent as to forbid further delay; so that unnecessary loss of blood, and to an injurious and alarming extent, was the result of this great practical error. In one instance, there was no hæmorrhage, but a constant secretion of pus: nor does it appear that such a process was better supported than loss of blood; for J— was more anæmiated, and had more of the malignant aspect, than any of the other patients. Excepting (in No. 3) where the polypus had only partially emerged from the uterine cavity, there was no difficulty in the operation; and even there, a longer instrument rendered the noosing of the growth easy and safe. In none of the women were there any after-symptoms, inducing solicitude or risk. In all, the hæmorrhage ceased immediately on the tightening of the ligature; nor did it again occur;—a tolerably good proof that the hæmorrhage arises from the growth, and not from the uterus;—a fact receiving additional corroboration, from the attempt, by Mr. Sibson and myself, to inject a polypus; an account of which, with a drawing of a section of the growth, is subjoined.

Two of the four women were single; a third had borne three children; and the fourth, although long married, had never been pregnant.

It is scarcely necessary to say, that, in common with English practitioners, I prefer the ligature to the knife, in the excision of polypi. I once removed a small polypus by the latter method; and the hæmorrhage was alarming, requiring the plugging of the vagina for its restraint. There are two preparations, in Guy's Museum, of small polypi removed by incision; and it is recorded, that the hæmorrhage was extensive. This risk is avoided by the ligature; and in none of the numerous instances, where I have used it, has there been any bleeding on the separation of the growth. No case has yet come to my knowledge of polypus occurring a second time in the same individual.

AN ACCOUNT OF THE POLYPUS INJECTED AND EXAMINED BY
MR. SIBSON AND DR. ASHWELL.

When first received, the polypus was exceedingly soft and pulpy, from putrefaction. By means of a blow-pipe, vessels running on the surface were inflated; but from the pulpiness of the mass, it was impossible to insert an injecting-pipe. Mercury was, however, thrown into the vessels; but when it had run for a very short distance, a vessel into which it had entered, and whose calibre it was distending, gave way; and although its further escape was arrested by gentle pressure, the injection being continued, the mercury again burst forth at an adjoining part.

The polypus was now immersed in weak spirit, for several days; and its consistence was thus rendered much firmer. Mercury was again thrown in, by the pressure of a few inches of its own column; and although a great quantity escaped by the vessels terminating on the surface, yet a considerable number were filled.

The growth was rendered transparent by drying, that the injected vessels might be more easily distinguished: (they are well seen in the accompanying Plate, No. 2. fig. 2.) During the process, much of the mercury was necessarily driven

out, through the numerous apertures on its surface. A section of the polypus was then made, that the comparative vascularity of the surface and substance might be better observed.

The superficial vessels, which presented numerous anastomoses, varied in size, from a dimension little longer than a hog's bristle to that of a crow-quill. They ran in various directions, some of them having a convoluted appearance.

At the centre of the polypus there was a vessel, which originated in the peduncle, and ran in a straight direction for about an inch: when it had reached the bulb of the polypus, it became extremely tortuous in its course: it was about the size of a large crow-quill. There were several smaller vessels in the substance of the tumor.

PURULENT DISCHARGE FROM THE LINING MEMBRANE OF THE UTERUS.

Reported by Mr. JOSEPH RIDGE.

MARIANNE B——, aged 19, of florid complexion, ordinary stature, and sanguineous temperament, was admitted in July 1836, into Petersham Ward. She had been in service, and had enjoyed good health, until eleven weeks since, when she began to complain of uneasiness in the hypogastric region, with severe pain in the right groin, increased towards night. This was accompanied with a thick, yellow, and very fetid vaginal discharge, which has continued up to the present time. The catamenia have not been arrested; and they appeared a fortnight before admission.

Her general health has suffered: she feels weak, and indisposed to exertion. There is a profuse purulent secretion, which comes on at intervals, especially after exertion. On getting out of bed, or in endeavouring to evacuate the bladder or rectum, it passes per vaginam, by gushes, being preceded by a cessation for some hours. Occasionally, it continues for two or three days together; and then ceases, until its accumulation is relieved by a sudden flow. She has lumbar pain, and occasionally a distressing sense of fulness and bearing-down in the uterine region.

Sometimes the pains are severe and lancinating, extending to the pubes and groins: bowels costive: tongue slightly furred: pulse rather full, and moderate.

These symptoms continued for several weeks, with but partial amelioration. The purulent secretion was, at intervals, diminished; but soon afterwards recurred, in equal quantity. She passed over two catamenial periods; and the discharge appeared to be intimately mixed with the sanguineous flow. Some shreds of membrane were discovered, being preceded by more than usual pain.

The treatment consisted in the exhibition of laxatives, with occasional topical bleeding, and sedatives to allay constitutional irritation. An opium suppository was used, with a belladonna plaster to the loins. Injections of an astringent kind, variously modified, with the hip-bath, were employed, but with little advantage.

The obstinacy of the disease, and the marked debility accompanying it, determined Dr. Ashwell to inject the cavity of the uterus with tepid water. This was effected by introducing a gum-elastic catheter with an open mouth, the edges being smooth, within the cervix, and propelling the fluid through its tube. Considerable pain over the pubes followed, which was relieved by anodyne fomentations. The discharge greatly abated, and a second injection was ordered. This was followed by more severe symptoms, and marked evidence of hysteritis; which was relieved by bleeding, both general and local, purgatives, fomentations, and a strict antiphlogistic regimen. The discharge ceased with the cure of the hysteritis; and in a few weeks she was presented, feeling quite well.

REMARKS.

I was not prepared for so alarming an attack of inflammation, as the consequence of the injection merely of warm water; although in a case entirely similar, and cured by injection, sent to me by Mr. Morgan, hysteritis of marked severity followed the use of a very weak solution of the sulphate of zinc. The remembrance of this induced me to employ tepid water only. It is well known, that in extensive uterine hæmorrhage, and in menorrhagia, cold water, and water

mixed with salt, may be thrown into the uterine cavity with impunity. But in these affections there is no disease of the lining membrane, which is doubtless present in the cases of purulent secretion. Thus it would appear, that morbid derangement of the mucous membrane of the uterus precludes the safe employment of astringent, and even of mild injections. In a former part of my communication, I have narrated the severe and dangerous results of an injection of a mild solution of zinc into an ovarian cyst; and it seems that similar risk attends similar treatment, where the mucous linings of cavities are secreting pus. It must, however, be recollected, that a cure was obtained by this measure, in both the instances of purulent disease of the lining uterine membrane: and the question is naturally suggested;—whether the risk is compensated by the probability of cure? It ought also to be a matter of some consideration, whether adhesion of the sides of the uterine cavity may not follow the inflammation necessary for cure.

ADHESION BETWEEN THE WALLS OF THE VAGINA,
OCCASIONING RETENTION OF THE CATAMENIA.

Reported by Mr. HENRY OLDHAM.

ELIZABETH R—, aged 22, a well-developed girl, of short stature, florid complexion, and fair skin, was admitted into Guy's Hospital in February 1836, under Dr. Ashwell.

At the age of 15, she had some affection of the eyes: but with this exception, she enjoyed good health until ten months ago, when she first became troubled with headache, vertigo, and lassitude, a sense of fulness in the hypogastric region, with lumbar pain, capricious appetite, pain in the side, with irregularity of the bowels, for which she was received into the Hospital, under Dr. Cholmeley. At this time the catamenia had not appeared; and an examination was instituted, to ascertain if any mechanical obstacle existed. The parietes of the vagina, about two inches from the vulva, were found closely adherent; and fluid could be detected immediately above. Mr. Key divided the septum; and a large quantity of dark-coloured, viscid fluid, was evacuated. The opening was dilated with bougies; and she

shortly left the Hospital, feeling well. There was but one scanty appearance of the catamenia after this period; but her health was not materially deranged until six weeks of the present time, a white mucous discharge alone having occurred. A recurrence of the above-mentioned symptoms induced her to apply to me for advice: and, on examination, it was found that the divided surfaces of the vagina had again firmly united, but that the catamenial fluid was accumulated in small quantity only, which was proved by the absence of a fluctuating tumor above the cicatrix. Finding her general health somewhat impaired, and the morbid sympathies with the uterus, such as sickness, headache, &c., continually present, I prescribed laxative medicines, mild tonics, nutritious diet, and palliative remedies, to remove urgent symptoms. The symptoms became more severe, as the quantity of menstrual fluid increased; and she was re-admitted into the Hospital, under Dr. Ashwell. At this time, she complained of giddiness, headache, and tinnitus aurium, lumbar pains, with a sensation of fulness and bearing-down, occasional dyspnœa, uncertain appetite, depression of spirits, and great irregularity of the bowels, sometimes being troubled with diarrhœa, followed by constipation. The uterus was not to be felt above the pubes; but a feeling of fulness, not of distinct fluctuation, was communicated to the finger, on examination. The same class of remedies were used; under which, her general health improved: and in two months' time, the tumor above the united parietes was so distinctly bulging, as to warrant the evacuation of the retained catamenial fluid, which was less in quantity than on the previous occasion. In twelve hours after the operation, symptoms of peritonitis were present; which were met with active measures, such as, bleeding, both general and local, purgatives, calomel, &c. They, however, continued unsubdued, and she died.

The body was conveyed to the mother's house, where an inspection was obtained.

On opening the thorax, marked traces of recent pleuritis were universally diffused. The lungs, in some portions, were found to adhere to the opposed pleura costalis, by delicate bands of imperfectly-organized fibrin, which were

readily broken down. In other parts, layers of plastic lymph were found loosely attached to the pulmonary pleura, and within the pleural sac: on both sides there were three or four ounces of serous fluid, with some flakes of lymph floating in it. The depending parts of both lungs were gorged with blood and serum, which ran out from the two surfaces of a divided portion. The upper lobes were crepitant, but their edges too rounded. The heart and large arteries were healthy.

On opening the abdomen, layers of lymph were found on the surface of the liver, particularly around the acute margin, and between the convolutions of the intestines. This lymph varied in degree of firmness; appearing, at the under part of the liver, to be converted into a tolerably well-organized band of false membrane, attaching it to the opposed surface of peritoneum: in other parts, it was plastic; and in the pelvis, some little flakes were seen, swimming in serous fluid. The mesenteric glands were greatly enlarged, and also those along the psoas muscle and brim of the pelvis. Some of these were of a scirrhus hardness; others, of a chalky consistence. Those on the brim of the pelvis were particularly enlarged, so as greatly to encroach on the dimensions of the superior strait. The uterus, and its appendages, had not contracted adhesions; both anterior and posterior pouches being entire. They were removed from the body, and presented the appearances so well shewn in the accompanying Plate, No. 2.

The situation of the stricture was a little more than an inch below the os; and above this part, the vagina appeared thin and distended, forming a continuous line with the dilated os, the circumference of which was above four inches. The cervix rapidly became thicker; and, for upwards of three inches towards the fundus, the parietes were fully double their normal size. The upper half of the body of the uterus was somewhat more bulky than natural, and its cavity slightly increased. The broad ligaments were unaffected, but their appendages were much less delicate than natural. There was a cavity within the cervix, which formed the chief dilatation, so expanded as to be able to enclose a goose's egg. The rugæ and cells of the cervix were greatly

diminished, and their surfaces presented a slight appearance of fibrinous effusion. Some few longitudinal striæ were visible, more particularly at the posterior part, apparently the result of a recently-contracted cavity.

REMARKS.

The preceding case confirms the opinion, that operations about the vagina and perineum are occasionally followed by inflammation of the peritoneum; and it ought to induce caution in the prognosis. The first division of the septum was not succeeded by mischief of any kind; yet, although there was no difference in the method of operating, a second incision through the parts led to a fatal attack of peritonitis. The distention of the cervix, while the fundus and body of the uterus retained their normal form and size, is singular; and corroborates the statements, lately made, as to prolapsus of the neck of the uterus by stretching, and perhaps by growth, while the parts of the viscus, above the cervix, remain in their original state. If, as this case proves, effused fluid may distend and stretch the cervix, independently of other parts of the organ, it is not difficult to conceive that the same result may occur from other causes. The Drawing illustrates most clearly the peculiar modelling of the cervix, under the distending influence of the retained catamenia.

MALIGNANT DISEASE OF THE EXTERNAL GENITALS, COMPLICATED WITH PREGNANCY.

Reported by Mr. JOSEPH RIDGE.

MARIA T—, aged 38, a woman of middle stature, with a somewhat emaciated appearance, her countenance denoting anxiety and distress, was admitted under Dr. Ashwell, 30th of August 1836. She is the mother of four children, the last of which was born three years since. Her health has been good; and she has followed the occupation of weaving, excepting during the last three years, when she has been engaged as a nurse. She is now six months gone in pregnancy; and the catamenia have recurred, though pale and scanty, and for two or three days only, during her present

gestation. About 12 months ago, in an attempt to raise a bulky patient, she strained herself; and felt something give way in the left groin, which was succeeded by a swelling about the size of a hen's egg, and obliged her to keep her bed. This gradually subsided, leaving the part hard and knotty; and the surrounding integument shortly assumed the same appearance. During the last five months, this disease has greatly increased, the parts becoming more swollen and vascular; and within the last month, ulceration, with hæmorrhage, has commenced in the most prominent parts. This disease, which appears to be a carcinomatous tubercular deposit, extends, at present, from the left groin down to the labium, involving the upper part of the nymphæ, and reaching the Mons Veneris (vide Plate); and on this side the most projecting parts are ulcerated, discharging a thin ichorous fluid. The neighbouring integuments are occupied by distinct scirrhous tubercles. The right groin is less affected; although its skin is elevated, and the right labium hard to the touch, and much swollen. The vagina is healthy. She suffers severe stabbing pains in the diseased parts, and a more fixed pain in the back. Tongue slightly furred. Pulse soft, and rather quick. Bowels open. The fetal heart and placental souffle were readily distinguished.

Cataplasm Conii part. affect.

Jul. Ammon. Acet. c Sp. Æth. Nit. et Tinct. Hyoscy. aa m. xx. t. d.
Liq. Op. sed. m. x. ex Mist. Camph. o. n.

The conium poultice failed to relieve the severe lancinating pains; and some vin. opii, soaked in lint, was applied over the surface. She was ordered nutritious diet, with wine and porter. Some ol. ricini was ordered occasionally, and a light bread-poultice was applied over the lint and vin. opii: by this means the acute pain was mitigated, but the disease rapidly increased. In the course of a fortnight, the whole of the external parts of generation were found involved; the os externum was contracted, and some parts were softening down. The anxiety of countenance became more confirmed; febrile paroxysms came on at night; the extremities were daily emaciating; and the pain was more severe.

On the 23d of September, three weeks after her admission,

Dr. Ashwell punctured the membrane, with the view of inducing labour; and some liq. amnii immediately escaped.

In 19 hours afterwards, labour-pains commenced; and during this interval her local sufferings had been much relieved, and she had enjoyed several hours sleep. Every advantage was given, by restraining the rapid advancement of the foetal head, for a gradual dilatation of the external parts; but as labour progressed, the labia became everted, and some dark grumous blood was discharged from the left. As the head was urged towards the outlet, it became evident that the latter would not allow its exit, without tearing away a considerable portion of the diseased structure, and giving rise to such a hæmorrhage as the enfeebled state of the patient's powers would ill sustain. At this time, Mr. Lever came to my assistance; and finding the head unusually firm and large, and that no pulsation was perceptible in the fontanelles, he determined to perforate the cranium. The greater portion of the brain escaped, with much blood; and the uterine efforts quickly expelled the collapsed head, the shoulders and nates gently following it. A slight laceration of the fourchette occurred, notwithstanding the firm support afforded to the perinæum, but it did not extend to the softer, or, rather, less scirrhus parts. The placenta soon followed. The uterus firmly contracted, and, excepting a slight oozing from the morbid growth, scarcely any blood was lost. The child was well formed, and judged to be a little beyond the seventh month.

Sumat. Tinct. Opii m. L. ex Aq. Ment. statim.

Shortly after delivery, some brandy and water was administered, as she seemed exhausted, in the evening. She had passed urine without pain, and was comparatively free from pain. No hæmorrhage. Thirst: pulse 130, fuller: skin hot. She was ordered,

Cataplasm. Panis. part. affect.—Sago, Barley-water, &c.

August 25. Countenance improved, and she feels better. Pain in the external parts returned in the night, which appear much the same as before delivery. Tongue moist: skin perspirable: pulse 125, soft and compressible: very little lochia.

Toast-and-water, with Isinglass, Arrow-root, &c.

Capiat Liq. Op. sed. m. xxv. horâ somni.

In the evening she had experienced a slight rigor; which was relieved by extra clothing, and warm applications to the feet. The abdomen somewhat fuller.

Ol. Ricini cras manè, c̄ Tinct. Opii m. x.

26. Bowels twice opened. There is some tenderness, on pressure, over the right side of the abdomen: the liver is felt large, and low down: the breasts are filling: pulse 125, compressible: heat of surface, moderate: tongue more furred, inclined to brown.

Vespere. The abdominal tenderness is increased, and there is more flatulent distension: she complains of weakness, with lumbar pain: some heat of skin. Pulse 135, compressible: very little vaginal discharge.

Cataplasm. Sinapis abdomini.—Empl. Belladon. lumbis.—Applic.

Hirud. x. abdom. si dolor augeatur; et postea, Fetus calid.

Tinct. Castor. Sp. Lavand. C. aa ʒij.

Ammon. Carb. ʒi. Tinct. Opii ʒi. m.

Fiat mistura, cujus capiat. cochl. i. min. sextis horis, ex aqua.

27. Abdominal tenderness removed: skin cooler and moist. pulse 130, soft. There is pain about the left hip; over which there is an erythematous redness.

Fot. Papav. coxæ.

28. She is looking much better: the abdomen is free from pain: erysipelas is extending over the hip, and there is effusion in the cellular tissue beneath: the mammae are distended, and tender: they have been fomented, and the milk drawn from them by an exhausting-pump. Pulse 125, soft, and easily compressed: tongue moist.

Beef-tea—Sago—Wine.

29. Improving: the erysipelas is less apparent.—Pergat.

30. She has passed a restless night; and her countenance is now greatly depressed: there is some tenderness around the umbilicus: bowels open: skin very moist: respiration hurried: tongue becoming brown. Pulse 130; small, and easily compressed.

Inf. Serpent. c̄ Ammon. Carb. gr. v. 4tis horis.

Vespere. She has passed three relaxed motions: no abdominal pain: respiration, 48 in the minute.

Enema Amyli c̄ Tinct. Opii ʒi. statim.

Pil. Sapon. c̄ Opio gr. v. 4tis horis.

Oct. 1. She appears gradually sinking. The diarrhoea was stayed by the opiate and enema: the skin is moistened with a cold perspira-

tion: the countenance is contracted, and fallen. Respiration 42, catching. Pulse 160.

Brandy and other stimulants were administered; but she died at 4 P.M.

INSPECTION.

The close pericardium presented three or four small hard tubercles: the pleuræ were copiously sprinkled with tubercles of the scirrhus kind; some were minute, pale and firm; others, varying from the size of a pea, presented flattened hemispheres, whilst a few more nearly approached a medullary character: the lungs were doughy to the touch; and there were some medullary deposits scattered in their texture, of a redder and more opaque nature than those in the serous membranes: the peritoneum was bathed by a reddish turbid effusion; and here and there, particularly on the portion covering the convexity of the liver, were some thin feeble layers of adherent fibrin: the liver was greatly enlarged, and lay widely expanded over the other viscera: its texture was very coarse and soft; and it was extensively occupied, within, and upon its surface, with cerebriiform fungoid deposits: upon the latter, they appeared as soft fluctuating projections, reddened by injected and extravasated blood. In the interior of the liver, these deposits were larger and more numerous; appearing, in some parts, as masses of white brain-like matter; whilst in others they appeared breaking down, forming cavities filled with grumous blood: the greater portion of the inferior and upper part of the liver was thus either dissolving or entirely broken up. The spleen was similarly invaded: the deposits were mostly of a lightish colour, and somewhat translucent; and others were in a state of ecchymosis and softening.

The uterus was of the size of a moderately large orange; its serous covering, clear and smooth; the walls pale, loose, and flabby: the lining membrane was somewhat dark and turgid; and in parts, especially where the placenta had been attached, it appeared coarse and rugged. The cervix was thin, soft, and flaccid: the anterior of the os was tumid and hard, and the seat of a scirrhus deposit: the vagina, in its upper part, was wide and smooth; but below, the surface was firm and indurated.

The lumbar glands were greatly enlarged, from a medullary fungoid degeneration.

The other organs were healthy.

REMARKS.

A disease of the kind already described, co-existing with pregnancy, is, happily, not at all common: still, there can be no difficulty or doubt as to the treatment.

If the ulceration had been stationary, or limited to a circumscribed and small locality, it would have been right to have allowed gestation to proceed uninterruptedly: as it was, the lives of both mother and child were endangered by the continuance of pregnancy: the former was compromised by the rapid progress of the ulceration, which in great measure depended on the excitement of pregnancy, and the increased vascular supply consequently furnished to the diseased structure; while the chance of preserving the life of the latter was daily diminishing; for the fœtal bulk was increasing, at the same time that the passage through which it was to be propelled was rapidly narrowing.

If, therefore, the mother could have lived sufficiently long to have allowed of the completion of the term, it is all but certain that the normal form and structure of the vagina and os uteri would have been so destroyed, by ulceration, and by vascular fungous growth, as to have precluded any other method of delivery than by the Cæsarean incision: nor is it all probable that the life of the child could have been maintained, under such sufferings, emaciation, and exhaustion of the mother. These circumstances, then, determined me to bring on premature labour: nor does the result of the practice invalidate the correctness and expediency of the principle on which it rested;—the patient's sudden and rather unexpected death being attributable to the latent peritoneal inflammation and intestinal disturbance, induced by the very advanced state of the hepatic disease, aided, perhaps, in some degree, by the tendency to peritonitis so common after parturition, and, as already observed, after any operation connected with the pelvis or its viscera.

The following remarks, additionally, confirm the opinions

I have expressed, and the practice I have recommended in the First Volume of the Reports, as to the induction of premature labour in pregnancy complicated with tumor.

Pregnancy, whatever may be said to the contrary, is not unfrequently complicated with malignant tumors of the uterus itself, of the ovary, and with those of a purely adventitious character; growing either from the abdominal or pelvic cavities, and giving rise, in labour, to difficulties of the worst kind.

It can scarcely be necessary to confirm these statements by extended reference; but I may mention the eighteen cases of Dr. Merriman, numerous others, and my own, as clearly proving the not uncommon coincidence of conception with tumors dangerously obstructing labour. A perusal of Mr. Hewlett's case, in the Seventeenth Volume of the *Medico-Chirurgical Transactions*, of several of Dr. Merriman, and of my own (Nos. 1, 2, and 5), will satisfactorily establish the malignancy of the growths themselves. I might enlarge here; but sufficient testimony has been perhaps adduced, to confute an opinion, "that the coincidence of conception, with a disease of the uterus, already malignant, is exceedingly rare."

I propose to evade the dangers of inflammation of the pelvic tissues and peritoneum, and of the still more hazardous evils of unhealthy softening, suppuration, and ulceration of the tumors themselves, by the simple and safe expedient of premature labour—a practice accidentally suggested to me, and enforced, on reflection, by the fact, that death had frequently occurred where pregnancy was so complicated, under the best known treatment, exclusively of premature labour artificially induced. Nine out of the eighteen cases which fell under the notice of Dr. Merriman terminated fatally: Mr. Hewlett's case was equally unsuccessful: and three of my own patients fell victims to gangrenous inflammation of the tumors, produced by their contusion during the process of delivery. Worse results could not have followed premature labour; and I feel confident, that, had it been induced, several lives would have been saved. It may be inquired, whether there was not sufficient mischief done to the uterus, in these cases, to insure a fatal

event? Certainly not. In most of the cases mentioned by Dr. Merriman, there is no allusion to the condition of this viscus; and when there is, it is stated, with one exception only, to have been healthy. In Mr. Hewlett's and my own examples, the womb was free from inflammation. I believe these patients to have been destroyed, as others will be, where premature labour is not practised, by morbid and malignant changes in the tumors themselves;—collapse, and final sinking, having been induced, much in the same way as after pressure and strangulation of an intestine, or after contusion of the soft parts in difficult labour, where an inspection after death commonly brings into view intense inflammation, and sometimes gangrene and disintegration.

A valuable corroboration of the propriety of the practice is furnished by the marked success attendant on puncturing the tumors, especially where their contents were fluid, or considerably viscid; and, in one or two instances, where blood only escaped. By this operation, the bulk and tension of the tumor is diminished; and the double purpose is accomplished, of a partial removal of the obstacle hindering parturition, as well as a preservation of the growth from that severe pressure and contusion which may lead to rupture of its parietes, inflammation, or gangrene of its substance.

The six cases published by Mr. Park, of Liverpool, in the Second Volume of the Medico-Chirurgical Transactions, are equally in point. Puncturing the tumors was the most successful of all the measures adopted: and it is worthy of observation, that the only fatal termination occurred in a case where the tumor, occupying the recto-vaginal septum, was subjected to the pressure and contusion of the fetal cranium for three days. Delivery was eventually accomplished by the natural efforts; and the patient died in twenty-four hours, from vomiting and constipation.

A perusal of all that has hitherto been written on the subject will satisfy any one, that the procedure to be adopted in these unfortunate complications, at the time of labour, is by no means clearly defined. If the opposing growth can be pushed above the brim, the difficulty of parturition is at an end; but if it cannot be so raised, although

puncture of the morbid structure is the best remedy for tumors with fluid contents, it will avail little, in the management of solid and very hard growths. Extirpation by the knife may be thought of; but the connections of the tumor, the shock of the operation, the probable hæmorrhage, and the subsequent inflammation, are events too certain, and too hazardous, to allow of a favourable prognosis.

These remarks are strictly applicable to morbid enlargements opposing the descent of the child; but they are equally pertinent to hard and malignant tumors of the uterus itself, and to ovarian and other growths of such magnitude and firmness of attachment as to preclude the possibility (vide Mr. Hewlett's and my own cases) of their being lodged in the abdominal and pelvic cavities, together with the gravid womb, without exciting pressure and contusion. This observation is especially true where pregnancy is complicated with one or more hard tumors imbedded in the uterine parietes. If the induction of premature labour were dangerous to the mother—if it increased her risk at the time, or if afterwards it placed her in a worse position than she had previously occupied—objections to the practice would carry great weight. It is, however, satisfactory to know, that none of these evils are the effect of premature labour artificially induced. Dr. Hamilton, of Edinburgh, my friend Dr. F. H. Ramsbotham, and many others, have frequently resorted to the practice, without the slightest bad consequence. My own testimony, from a rather large number of cases, is equally favourable.

I think, therefore, I may regard as proved, that great advantage will accrue from this method, where the tumor cannot be raised above the brim; where it is situated in the abdomen, and is of such size as to restrain the development of the uterus without painful pressure and contusion; or when the growths are in the uterus itself.

**LABOUR, WITH PLACENTAL PRESENTATION, WHERE
TRANSFUSION WAS TWICE PERFORMED.**

Reported by Mr. JOHN JAMES JACKSON.

CASE 1.

HANNAH C——, aged 39, a delicate-looking woman, with dark hair and eyes, and of a consumptive family, applied, on the 3d of December, to be attended from The Guy's Hospital Lying-in Charity, with her ninth child. She stated, that her feelings were different to what they had been during any previous pregnancy; and that, at times, she experienced an uneasy sensation, which she referred to the womb. She likewise had a cough, which was relieved by the common linctus of the Hospital. On the 18th, when getting out of bed, she was seized with a severe fit of coughing, followed up by a sudden discharge of blood from the uterus, amounting to about half-a-pint. When I saw her shortly afterwards, her countenance and general surface were exsanguineous; pulse 100, irritable; considerable dyspnoea, with an anxious aspect; bowels constipated. She was ordered, acid. sulph. dil. m.x.; mag. sulph. ʒi.; inf. rosæ comp. ʒiij.; to be taken immediately, and repeated every five hours. All the bed-clothes, except a sheet, were withdrawn; and she was cautioned to take no warm fluid; to maintain the recumbent posture, with elevated hips, and perfect quietude. In the evening, she was greatly improved: her pulse had fallen to 82, and the hæmorrhage had entirely ceased: she complained of grinding pains, for which she was ordered opii gr. i., to be taken at bed-time. The remedies being continued for a few days, she recovered from her weakness, and could not be kept quiet any longer. On the 14th of January, at three o'clock in the morning, I was again sent for; and found she had lost nearly a pint of blood; owing, as she thought, to anxiety of mind, caused by the recent loss of several relatives, the dangerous illness of her brother, and the unkindness of her husband, who had alarmed her, by his violent behaviour, that night. I exhibited similar remedies to those used before; enjoined a strict observance of the horizontal position, her hips being raised by a firm cushion; and applied cloths dipped in cold

vinegar and water to the lower part of the abdomen. This was attended with success, as far as regarded the bleeding; though the pains continued at intervals till Friday night, the 22d, when suddenly there was another discharge of blood: her spirits became depressed; her pulse quick, and small; severe pains occurring every twenty minutes, accompanied with the expulsion of clots of blood: the liquor amnii was also trickling away. Availing myself of a pain, I examined, and found a small portion of placenta projecting over the posterior edge of the os uteri, which was yielding. I now sent for Mr. Lever. After his arrival, there was no further uterine effort, or bleeding: the pulse was 120, small, and the patient excessively low: on examination, he found the presentation, as stated—the os dilatable, and the head within reach. He ordered *tinct. opii m. xxv.*, and enjoined quiet. During the two following days, the liquor amnii continued to escape: she was more comfortable; took her medicine; and, an anodyne being exhibited at night, she slept tolerably well. On Monday morning, although no subsequent hæmorrhage had occurred, there was sudden dyspnœa, with jactitation of the upper extremities; pulse quick, and small; no uterine effort; and every indication for a speedy emptying of the uterus. I ordered brandy, slightly diluted with water, to be administered to her, by means of a tea-spoon, every five minutes; and went for Mr. Lever, who immediately delivered her of a still-born child, by turning; Dr. Ashwell being present. After the child had been withdrawn, and the placenta removed, Mr. Oldham and myself alternately continued a steady grasping of the uterus for several hours; during which she had some mild nourishment, with brandy, given to her at intervals. The hæmorrhage consequent on the turning, although slight, had been sufficient materially to aggravate her already-prostrated condition. The abdomen was tightly bandaged; and she was desired to keep perfectly still, avoiding even conversation with those around her. An opiate was given in the evening, but she obtained little sleep. Early on Tuesday morning, she begged to have her linen changed, and the nurse, unfortunately, acceded to her request: soon after which, the jactitation of the limbs became more violent, and it was found

impossible to prevent her throwing herself about on the bed: she spoke incoherently about her brother; and it was evident she was rapidly sinking. I gave her brandy repeatedly, and the julep ammoniæ at intervals, but without success. At 3 P.M. Mr. Tweedie performed the operation of transfusion, taking the blood from Mr. Lever; and about 3vij. were injected into the median basilic vein. The effect of this, for a time, was surprising: her pulse, from being excessively rapid, and at times imperceptible, became full and distinct; her eyes regained their natural expression; and she spoke rationally and calmly. We now gave her a tea-cup-full of rich soup, repeating it and the brandy, at intervals, every quarter of an hour. At 4 P.M. she had again relapsed into a state approaching to insensibility; when Dr. Ashwell repeated the transfusion, taking the blood from her husband: she, as before, rallied for a time, but not to the same extent; then rapidly sunk, and expired a few minutes after five o'clock.

REMARKS.

This case is instructive, as shewing that not only after large hæmorrhages, but even where the loss has not been so considerable, there is something wanted to revive and re-establish the living principle, which the supply of blood cannot furnish; and although I am far from believing that in all the instances where recovery has followed transfusion, the result would have been equally favourable without it, still I believe that an exhausted brain, even where sensibility remains, cannot be thus restored, where real sinking has fully set in.

PREGNANCY WITH IMPERFORATE UTERUS.

Reported by Mr. TWEEDIE.

ELIZA P—, aged 23 or 24, an Irish woman, residing at No. 105, Little Suffolk Street, Southwark, a patient of Guy's Lying-in Charity, was taken in labour, with her first child, on the 14th or 15th of November, 1836. Mr. Roe, the gentleman to whom the case had been entrusted, was called to her at seven o'clock in the morning. He was informed that she had been in strong pain since the preceding evening, but there had been no show as yet. Mr. Roe observed the

pains to be urgent and very powerful ; but although he remained several hours with her, he had not succeeded in discovering the os uteri.

Puzzled with this novelty (for he had attended a great number of confinements), he requested me to visit her. It was now two o'clock : the patient was on her bed. On examination, I found a firm, uniform, globular mass forcing down into the vagina at every pain (which was of great force), but no irregularity upon its surface could be detected ; and a very careful examination of the entire vagina, whose extremity was easily reached at all points, failed in detecting the os uteri. As her bowels had been confined for two days, Mr. Roe had administered a dose of castor-oil : so we waited a few hours, to see what nature would do, as well as to afford the oil time to operate.

In the evening, I again met Mr. Roe, to see the patient. Labour-pains had persisted, and were of unusual severity : the castor-oil had acted once. A most careful investigation of every part of the vagina failed to detect any os uteri. At the upper part of the canal, at each pain, there was forced down this tight, tense, globular body, of the bulk of the child's head ; and conveying the impression of an entire uterus, without orifice.

About the spot where the os uteri should have been, was a minute portion, somewhat thinner than the surrounding parts ; but the whole was uniformly smooth, and contained no break whatever.

On the receding of the mass, in the absence of the pain, something like a child's head could be felt within.

Inquiries were now made, and the following facts elicited :

Mrs. P—— was married on the 4th of February preceding, 1836. Since the age of 14, she had menstruated every four weeks, sometimes every three weeks. The discharge was always pale and scanty, and continued from two to three days. She never suffered pain at those periods. She has not menstruated since her marriage.

Both before and subsequent to her marriage, she has had robust health ; and, in the necessary duties of her vocation, has undergone an unusual degree of laborious exertion, but she has not had a day's ill health. For two or three days

before labour came on, she noticed a rather copious reddish discharge, that continually drained from her; but there was no pain. On the subsidence of this, about the 12th, slight pains in the back were felt; which went on till the night of the 14th, when they assumed the severe and urgent character which occasioned her to summon her medical attendant at the time already stated.

Having satisfied myself, at this second examination, that there really was no orifice into the uterus, and the pains continuing of a severe character—and the existence of a living child being proved by the pulsations of the fetal heart, which were distinctly audible, about twice as fast as the mother's pulse—I sought the advice of Dr. Ashwell.

The Doctor lost little time in arriving: and having, by a most careful investigation, positively confirmed the statement of the condition of parts already made, he determined upon losing no more time in making an artificial opening across the above-named spot, where the globular body seemed slightly thinner than elsewhere. The patient's pulse was about 120 to 130: very irritable; the pains violent; the skin irregularly hot and cold; the features anxious; the mind irritable; general restlessness: the bowels had now been twice relieved by castor-oil. Accordingly, having placed her on her left side, the Doctor introduced his left fore-finger as a director; upon which he passed up a curved, sharp-pointed bistoury with his right hand; and having punctured the spot already fixed upon, he incised forwards towards the bladder (which was empty), and backwards towards the rectum. At this last incision, a few drachms of dark blood flowed out. The liquor amnii of course escaped; and the head fell upon the artificial opening, which proved to be of the diameter of an inch and a half, or perhaps nearly two inches, and about a line in thickness.

The Doctor did not incise laterally, lest he should wound any of the branches of the uterine arteries. At one o'clock A.M. of the 16th, he left the patient, in charge of Mr. Roe and myself. The pains abated for a brief space after the operation, the performance of which occasioned no suffering; so that she seemed not to be conscious of any thing, beyond the inconvenience of manual interference. Pains, however,

recurred; but little advance at dilatation appeared to be made for some time, till about four A. M., when, under the influence of a severe pain, the edge of the orifice tore suddenly towards the right side; and soon after, another rent took place, whilst my finger was at the part, backwards, towards the left sacro-iliac synchondrosis. At this, she became faint: the pulse was 140 or 150, feeble; the skin cold and clammy; and she fell exhausted. Æther, ammonia, brandy and opium, were administered, and she rallied. After resting for about two hours, pains recurred gradually, and became as powerful as at any previous time.

The extent of the laceration on the right side could be reached by the finger; it had not extended to the reflection of the vagina: that on the posterior part was beyond reach. No gush of blood attended these lacerations. The head became engaged in the pelvis, and was delivered at 11 A. M.

The latter pains were very inefficient; and much stimulant was administered towards the close. With the child there was a more than usual degree of hæmorrhage: the infant (a male) was asphyxiated, and was with difficulty revived.

The placenta was taken away in half-an-hour, and the uterus contracted well. Nothing further could now be detected, on examination, but several ragged shreds about the orifice at the top of the vagina.

The tongue was dry, and brown at tip; the head ached; the pulse was 110, jerking, (doubtless referrible, in some degree, to the stimulants). Towards the close of the labour, the bowels had afforded three copious motions.

Liq. Opii sedativ. m. xl. statim.

And, to meet the expected re-action,

*Haust. Efferves. c̄ V. Ant. Tart. et Tinct. Hyoscyami aa ʒ ss.
4tis horis.*

Barley-water.—Quiet.

5 P. M.—Has been visited by Dr. Ashwell, Pulse 104, no tenderness: tongue moister: bowels once more opened: has voided urine twice. Since the delivery, there has been a copious draining (with some clots), which has trickled along the floor, having penetrated the bed. This is principally urine; but there is evidently, also, a considerable quantity of blood. She has slept perhaps half-an-hour.—Pergat.

11 P. M. Has slept an hour, and is refreshed. Free from pain : no sickness : pulse 104. Has drank largely of barley-water.

Liq. Opii sed. 3fs. ; et pergat.

17 Nov. 10 A. M. Has slept about six hours. Pulse is only 84, soft : bowels open twice : urine free : tongue white, but moist : moderate perspiration : no tenderness. There has been slight draining, tinged with blood.

6 P. M. I was hastily summoned. She had had three motions, in quick succession ; and, with the last, there was much bearing down, followed by severe attacks of pain in the back and in front, with the expulsion of more clots. The pulse was 106, jerking : countenance rather frightened than anxious : there had been no rigor ; but there was some pain on pressure over the womb.

Pulv. Opii gr. i. statim.

She was supplied with a bed-pan ; with strict injunctions to maintain the recumbent posture, under all circumstances.

11 P. M. Has slept at least three hours. The pain has abated : there is almost none, on pressure. Bowels quiet : pulse 96, softer.

Liq. Opii 3fs. statim ; et pergat.

18, *Mane*. Has slept nearly all night ; and is quite free from pain or tenderness. Bowels open twice ; but the pan prevents any discomfort : pulse 90 : tongue white, moist.

Rep. Haust. Efferves. sine V. Ant. Tart. et T. Hyosc.

Vespera. Has been comfortable all day. Pulse about 90, soft : tongue cleaner : no pain : bowels open once : urine free.

Pergat ; et Opii gr. i. h. s.

19. Slept well. Pulse about 100, weak : bowels open twice : no pain. Discharge during the night was more profuse, with some clots of blood ; but the napkins have been put away. Asks for food. There is no milk, but the breasts are filling.

Haust. Efferves. c̄ Tinct. Opii m. v. 4tis horis.

Liq. Opii sed. 3fs. h. s.

Barley-water, and gruel.

Nov. 20. This morning, there is an abundant supply of milk in both breasts. The child sucks well from the right ; but the left is enormously distended, and has no nipple. There is an extensive areola, with a slight central depression, and no milk has passed from it : as yet there is no hardness, but she suffers a good deal from distension and pain. Pulse 110, jerking : tongue moist, slightly

white: bowels once open: no hardness, on pressure over uterus. There is a copious offensive discharge; but I have not been able to see a napkin.

Omit. Medicamenta.—Low diet.—Breast-pump.

Nov. 22. Mr. Roe used the pump yesterday, and, after much perseverance, succeeded in drawing forward a portion of the areola, and procured a large supply of milk: since then, the breast is comfortable and smaller, and the milk oozes from it spontaneously. Pulse 90: tongue clean: bowels open: sleeps well: no pain: is hungry. Discharge abundant, greenish, muco-purulent, and offensive.

Improve the diet; et pergat.

24. Child cannot seize the right breast; but it is small, free from pain, and the milk spontaneously issues from it. Discharge less, in other respects. Doing well.

25. Is doing well, and may be pronounced convalescent. Enjoined to keep her bed yet, for some days.

Dec. 4. On calling to-day, I find her weak, but well. Since the last report, she has had some severe pain and tenderness about the pubes; for which Mr. Roe (who has been most assiduous in his attentions) applied a few leeches, and the pain quickly subsided. There is still a profuse, greenish discharge from the vagina. Is weak.

Ordered a little Quinine.

14. Went this morning, in company with my friend Mr. Gaselee, to institute an examination into the present state of parts. It was with difficulty that even a manual examination was permitted.

A day or two after the last-reported visit, the discharge assumed a reddish character, and so continued between three and four days: it commenced, continued, and ceased like the catamenial fluid, and was attended by no increase of symptoms. She is now nearly free from discharge; and though weak, is at the tub, washing.

The following is the result of a careful investigation:—The vagina is short: its extremity, and every part of it, can be readily reached by the shortest fore-finger: it presents no other peculiarity.

There is no cervix uteri. The uterus seems reduced nearly to a normal unimpregnated size. At the extremity of the vagina, there is a puckered irregular orifice, into which the tip of the finger can enter: it is soft, with smooth and thick edges, not perfectly circular, in consequence of certain

indentations, as if from the drawing together of several small rents.

It might be compared to the base of an apple ; whilst this part of a normal uterus would better resemble the apex of a pear.

Radiating from this central aperture, can be distinctly felt three ridges, like lines of adhesion ; one passing forwards, towards the right ilio-pubic junction, traceable nearly to the reflexion of the vagina ; one opposite to this, backwards, towards the left sacro-iliac synchondrosis, whose extremity is lost in the reflexion of the vagina ; and the third, of short extent, about one-third of an inch long, passing backwards and to the right. These were distinctly ascertained, by both Mr. Gaselee and myself, to centre in, or radiate from, the aperture above named.

REMARKS.

This case is so singular, and is so accurately detailed, that it is scarcely necessary to make more than a single observation. I am not aware that a precisely similar instance is anywhere recorded : nor do I think that there can be any hesitation about the treatment proper to be employed. The safety of the incision consists in its prevention of unlimited and extensive laceration. So long as the division by the knife, and the subsequent tearing of parts, is confined to the os and cervix, and does not extend beyond the reflexion of the mucous surface of the vagina over these parts, recovery is highly probable : whereas, if the parts be left to rupture of themselves, the body and fundus of the uterus, and their peritoneal investment, are pretty sure to be implicated, and the result will most probably be fatal.

PLATE I.

**REPRESENTS A SECTION OF A VERY LARGE HARD TUMOR OF THE
UTERUS, DISPLAYING ITS STRUCTURE AND DEGENERATION.**

- A** Portion of the fundus uteri, pushed to the right side.
- B** Right Fallopian tube.
- C** Portion of the interior of the tumor (the painful part during life), shewing the unhealthy suppuration common in these growths.
- D** Proper structure of the tumor. The white membranous lines, traversing it in every direction, are clearly seen ; these, together with the hardness, forming the diagnosis of scirrhus from other diseases.

PLATE II.

Fig. 1.

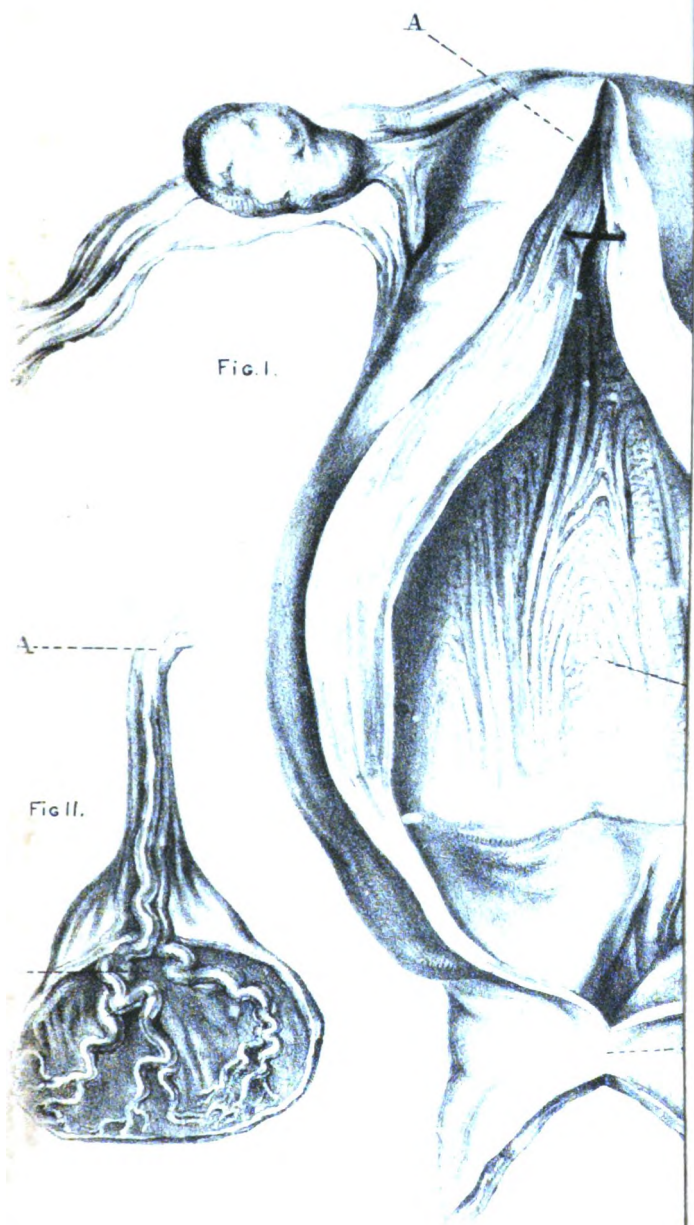
- A Upper half of the body of the uterus, with its fundus, somewhat enlarged.
- B The large cavity, which contained the accumulated catamenial fluid, partly formed by development of the lower portion of the body, but especially by dilatation and growth of the cervix uteri. The cavity is represented in a state of recent contraction, a process occurring after the evacuation of its contents. The longitudinal lines peculiar to the cervix and its thickened parietes are well shewn.
- C Seat of stricture, one inch and a half below the proper situation of the os uteri.

Fig. 2.

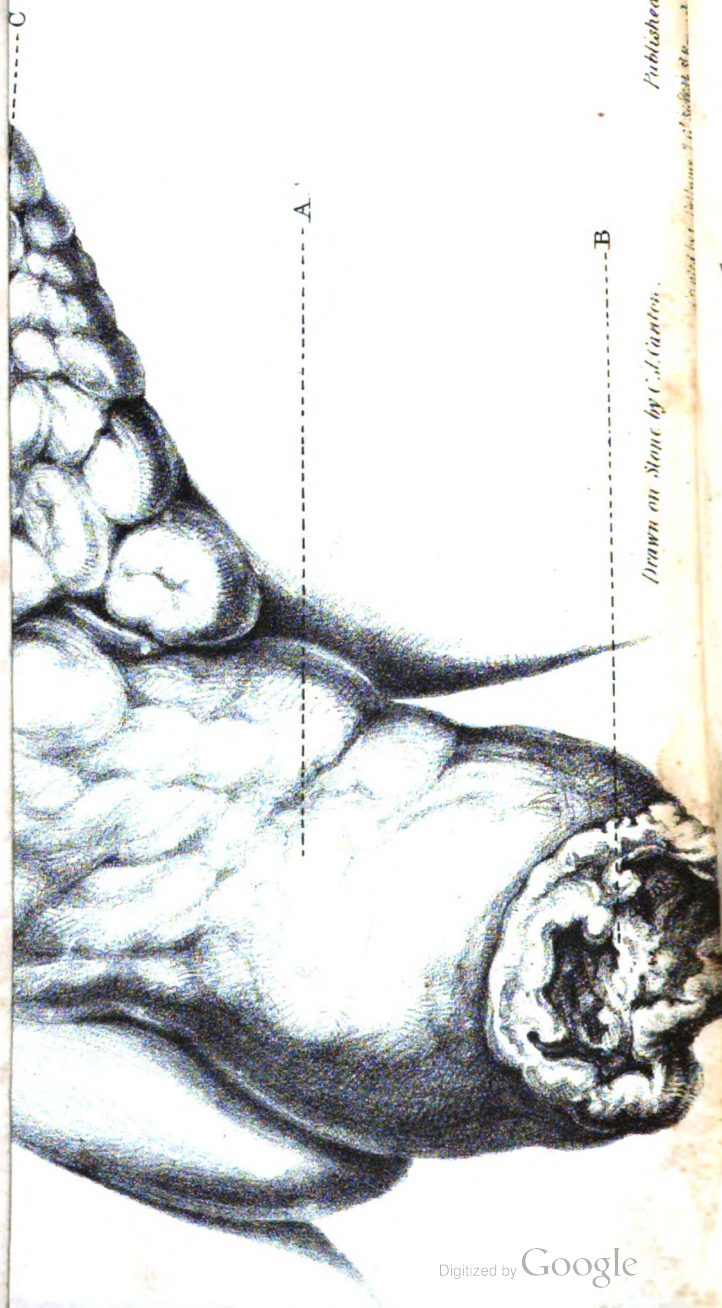
SECTION OF AN INJECTED UTERINE POLYPUS.

- A The Peduncle of the growth, with a large vessel passing down its centre.
- B Vessels running in various directions, through the section.

PLATE II.



Drawn on Stone by C. J. Canton.



Drawn on Stone by C. J. Canton.

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PLATE III.

**VIEW OF EXTERNAL GENITALS (IN TINNEY'S CASE) IMMEDIATELY BEFORE
THE INDUCTION OF PREMATURE LABOUR.**

- A Left labium, enlarged by tubercular, malignant deposit.**
- B Most projecting part, in a state of ulceration.**
- C Left inguinal region, occupied by indurated, knotty, and malignant deposits, highly vascular, and partially ulcerating.**
- D Right labium, hardened and enlarged.**

DESCRIPTION
OF A
REMARKABLE SPECIMEN
OF
URINARY CALCULUS:

TO WHICH ARE ADDED,
SOME REMARKS ON THE STRUCTURE AND FORM OF
URINARY CALCULI.

BY DR. HODGKIN.

THE specimens of calculus which I am about to describe, were taken, after death, from the much-thickened bladder of a boy about two years of age: they were nearly of equal size. The larger was about as big as a pigeon's egg, and nearly of the same shape; but rather longer, and not quite so broad: they were of a whitish colour, like many calculi composed of the phosphates.

Instead of presenting the hardness and resistance of solid bodies composed of earthy matter, they possess, on the surface at least, a degree of softness and elasticity, as if covered with a fleshy layer; a circumstance which explains the uncertainty of the evidence of calculus existing in the bladder, when the little patient was sounded, on suspicion of that being the case. Besides this peculiarity in the texture of the exterior layer of these calculi, the material, of which the surface was composed, exhibited a slight degree of translucence, not unlike that of some blighted acephalocyst membranes. These unusual characters induced, at first, some doubt respecting the nature of these bodies. A section made through one of them shewed that they, in part, consisted of an opaque white substance, having an earthy texture, arranged in concentric but fragile layers. (See Fig. 1.) Two or three thin layers, consisting of a material precisely similar to that of which the external coating of the calculi was composed, were situated between the layers possessing the earthy

character. Although the earthy layers were so brittle as to be crushed by the act of making the section, the fragments were so completely retained in their relative situations by the tenacity of the membranous layers, that the two portions into which the calculus was divided were able to retain their form and cohesion. The resemblance which the membranous layers bore to the membranes of acephalocyst hydatids was such as to induce an idea, in the minds of some who examined them, that such hydatids had really been concerned in the production of these calculi. I am, however, disposed to adopt a different explanation: 1st, Because it is inconsistent with the nature of acephalocysts, either to exist in the bladder, except when accidentally admitted into it through a preternatural opening from some other situation, or to be formed as an investment to any foreign body; and, 2dly, Because, if I am not mistaken, a more plausible explanation may be offered. Preparation No. 878, in the Museum of Guy's Hospital, is a specimen of fibrin, passed with the urine from the bladder of a lad who was in the habit of passing what appeared, when recent, a milky fluid, very slightly tinged with blood, giving it very much the appearance of some specimens of chyle. It also resembled chyle, in spontaneously coagulating, like blood; and forming a mass of crassamentum, moulded to the form of the vessel in which it stood. The preparation in the Museum is a specimen of one of these coagula. I am inclined to believe that the little patient who produced the specimen of calculi which I have described, must, at times, in consequence of the derangement of his kidneys or bladder, have produced urine having somewhat of the character which had become constant in the lad who furnished the specimen No. 878; and that a nucleus existing in the bladder at the time became invested with coagulated fibrin, as a stick does when agitated in recently-drawn blood;—that when the character of the urine again changed, the deposition of the phosphates took place, and inclosed the fibrinous layer. The repetition of these occurrences appears sufficiently to account for the production of these calculi, and to be strictly analogous to the process by which other alternating calculi are formed. The sight of this section imme-

diately suggested an explanation of the production of a peculiar appearance which I had noticed in one of the sections of calculi preserved in our Collection, and which had hitherto seemed not very easy to account for.

The calculus in question was composed of concentric layers of very different degrees of density ; some being firm and compact, and others so loose and friable as to afford a very feeble support to the denser layers. The peculiarity to which I refer, consisted in one of these layers having been broken into fragments, which, though very much disturbed as respects their relative position, still continued to surround the nucleus ; and, being inclosed by other unbroken layers, concurred to form one solid calculus. The interruptions and irregularities in the broken layer, produce an appearance resembling, on a small scale, the interruptions sometimes seen in the sections of a stratified country. The difficulty had been, to account for the rupture of the compact layer having taken place, without the fragments having become detached and separated from each other in the bladder : whereas it is evident that they must have remained, not only in approximation to each other, but have admitted of little or no motion amongst themselves ; seeing that the layers of soft phosphates have been deposited upon them without disturbance. This difficulty seems to be satisfactorily solved, if we admit the idea, that the firm layer was inclosed in a membranous layer, similar to those in the calculi before described, at the time when the force which ruptured it was applied. This closely-investing layer of a flexible material, by retaining its cohesion whilst that of the layer within it was destroyed, would necessarily retain the fragments in juxta position, although they had been somewhat displaced. The disappearance of other proofs of the existence of such a layer does not present any insuperable difficulty, since we might conclude, *à priori*, that such a layer, composed of water with a little animal matter, unsupported by organization, would soon be decomposed, and that its place would be partially occupied by depositions from the urine which the loose texture of the calculus would allow it to imbibe. (See Fig.2.)

The inspection of a large number of urinary calculi has at different times suggested to me some ideas respecting

their varieties of form and structure; which it may not be amiss for me here to offer, in addition to those contained in the preceding remarks.

It is evident, in many instances, that the particles separated or precipitated from the urine to form calculi assume a crystalline character; and the mode in which this crystallization takes place around a small nucleus materially influences the structural character, and the form of the calculus. The structure is radiated, and the form more or less rounded. Even the evident marks of increase of superposition by layers does not destroy this radiating character; and the surface is often roughened by manifest crystallization.

Such specimens of calculi bear considerable analogy to certain zeolites, and to some specimens of radiated quartz. The cystic oxide affords one of the best specimens of decidedly crystalline calculi. The state of purity in which this substance generally exists is, perhaps, one of the circumstances the most favourable to the production of a distinct crystalline character. Some of the phosphates appear to come next to the cystic oxide, in presenting this character. Fig. 3. is copied from a portion of one of these calculi; which, if placed in a collection of minerals, might, at the first glance, be mistaken for a specimen of messotype. Calculi, consisting of oxalate of lime, frequently present evident traces of crystallization, but, for the most part, under certain modifications, which render it necessary for me to speak of them separately.

In many instances, the molecules which unite in the composition of urinary calculi do not possess a perceptible crystalline form; and the resulting substance is what mineralogists would call massive, with no other indication of structural arrangement than more or less distinct traces of superposition in concentric layers. Calculi of this class present a great variety in their mechanical structure, as well as in their chemical composition. In some, there appears to be a slow and uniform deposition, like that of the well-known incrustations of carbonate of lime formed in the baths of San Filippo, near Radicofani. Such calculi possess a firmness of texture, which admits of a very fair polish. In

other cases, the precipitated particles are so loosely coherent, that the substance of which they are formed seldom admits of section without crumbling to pieces. There is considerable variety in calculi of this description; some possessing a granular texture, which might be compared to a coarse sort of sandstone; whilst in others it is soft and earthy, like some of the softest specimens of chalk or tufa. The lamellar arrangement is very differently perceptible in different specimens of this kind of calculus: in some it is strongly marked, and the calculi, which are easily crushed, separate in shell-like flakes; whilst others, in which the arrangement is less conspicuous, break up almost indifferently in all directions.

As forming an intermediate link between calculi possessing a distinct crystalline character, and those in which the texture may rather be regarded as amorphous or massive, I may mention those calculi which present a mammillated surface, and which, on close inspection of a section or fracture, appear to have their several lamellæ made up of short fibres; at right angles to the plain of the lamellæ. These are often an assemblage of acicular crystals: indeed, the crystalline form is sometimes evident upon the surface. This form of calculus is most frequent and remarkable in those specimens which are composed wholly or chiefly of oxalate of lime; and the name of mulberry calculus is doubtless derived from the resemblance to the surface of a mulberry, which the assemblage of round elevations or mammillæ produces; whilst the dark colour common to these calculi tends to render the similarity more striking. This arrangement is not, however, peculiar to calculi composed of oxalate of lime. It may be seen, though less frequently and less remarkably, in calculi wholly or principally composed of lithic acid. This modification of crystalline arrangement is exhibited in various minerals: it is not very uncommon in hæmatites and other oxides of iron, in black oxide of manganese, and in magnesian limestone. The mammillated elevations are sometimes elongated in a very considerable and remarkable manner: and although they all seem to radiate from a common centre, they differ most essentially from acicular crystals, which are also frequently

seen shooting from a common centre. The elongated mammillæ do not take so straight a course; and instead of terminating by regular angular facets, they are blunt and rounded, and often present smaller mammillated elevations upon their surface. The only calculi, I believe, which present this extension of the mammillated form are those composed of oxalate of lime; in which it sometimes proceeds so far, as to produce a perfectly stellate figure. The most remarkable and beautiful specimen of this kind which I have seen was shewn me by my friend Professor Mussey, of New Hanover, in the United States; who has, I believe, published a description of it, accompanied with a figure. The radii in this specimen must have been at least half an inch in length, and not more than the tenth or twelfth of an inch in diameter: they were united by a very small central nucleus. The whole constituted a star of such delicate form, that it was truly surprising that it should have remained unbroken in the bladder.

The shape of some calculi is evidently influenced by that of the body which constituted the nucleus upon which the material composing the calculus is deposited. We may see this in the incrustation which, in the course of a few days, envelops the catheter left in the bladder. A needle has found its way into the bladder, and become the nucleus of a long and slender calculus. Sir A. Cooper used, in his Lectures, to mention a similar example; in which the nucleus was a silver tooth-pick, which had been introduced into the bladder. And Fig. 4. represents a calculus, in the Collection at Guy's, which has for its nucleus a piece of tobacco-pipe, which a man, in a state of intoxication, had attempted to employ as a bougie.

The intestinal calculi occasionally found in horses and other inferior animals sometimes exhibit the influence of the nucleus, in modifying the form of a concretion. In the Museum of Comparative Anatomy, there is a specimen of this kind, presented by Luke Howard. It has the form of a very oblate spheroid, evidently dependent on the nucleus, which, in this instance, was the metallic disc of a button.

Urinary calculi not unfrequently owe their form to that of the cavity in which they are lodged. The most striking

examples of this are seen in nephritic calculi, which, in some specimens, are completely moulded to the form of the pelvis and infundibula. A similar influence is occasionally exhibited in biliary calculi; sometimes a single one, and sometimes two, completely filling the gall-bladder, and assuming its form, and even extending, to a short distance, into the ductus cysticus.—See Specimens in the Museum, No. 1978, and 1987.

Although the form of urinary calculi is modified by the nucleus upon which the calculous matter is deposited, and partly by the form of the cavity in which they are lodged, these are not the only causes by which their figure is affected. The greater thickness of the deposited layers, at a particular part of the calculus, frequently alters the form, by occasioning a more rapid increase of size in one direction than in another. (See Fig. 5, and 6.) The thickest and most rapid deposit appears to take place at that part of the calculus which is exposed to the largest bulk of the urine. It is, consequently, towards the fundus of the bladder that the calculus receives its deepest, but, at the same time, its most fragile layers. This fact is most remarkably seen in sections of calculi composed of the crystallized phosphates. This unequal increase of calculi in different directions is a complete proof, that they do not change their position in the bladder nearly so much as might have been expected. Even calculi of small size sometimes exhibit this unequal deposition in a very remarkable manner. It is occasionally seen in lithic acid calculi; although, in general, calculi of this description are composed of very uniform layers. The fact, that the loose, soft, and white calculi, composed principally of the phosphates, most frequently possess this inequality, tends to confirm a remark, already made by Dr. Marcet and Baron Heurteloup, that these phosphatic calculi depend as much on the diseased secretion of the bladder itself as on any peculiarity in the urine, as transmitted from the kidneys*. The compressed and flat-

* The production of pseudo-membranous layers, and of earthy salts, by the mucous membrane of the bladder, when in a state of disease, in the human subject, appears to be not altogether without analogy to the normal
and

tened form of many calculi cannot, in my opinion, be very satisfactorily accounted for. Baron Heurteloup ascribes it, in some instances, to the original nucleus; but in the lithic-acid calculi, which principally assume this form, the nucleus is generally so small, that the addition of numerous layers of uniform thickness would necessarily tend to produce a sphere. We are therefore obliged to admit, that these flat calculi must maintain, if they do not originally receive, their form by more copious deposition at their circumference. Something may, perhaps, be ascribed to the circumference being always ready to receive accessions of deposit, whilst of the flat sides one only is exposed at a time.

It might not unreasonably have been supposed that the urine descending from the kidneys would deposit its salts upon that part of the calculus which corresponds with the orifices of the ureters; just as incrustations of carbonate of lime accumulate where water charged with that salt is constantly poured out; or, to offer a still closer analogy, as the molar teeth become encrusted with tartar opposite to the duct of the parotid gland. Were such a deposit to take place, it is probable the misery of patients labouring under vesical calculus would be greatly increased; since processes from the calculus would be formed, which would not merely irritate a very sensible part of the bladder, the neighbourhood of its neck, but the passage of the urine from the kidneys to the bladder might in some instances be seriously interfered with. When we see that the urine, as it is secreted in the kidney, is liable to deposit calculous matter of different kinds, before it has been concentrated by retention in the bladder, as is shewn by the formation of renal calculi, this exemption is the more remarkable, and the cause of it not very evident.

When two or more urinary calculi exist in the bladder—

and abnormal productions of a part of the urino-genital mucous membrane in birds and reptiles: the Normal productions being the shell and some of the humours of the ovum. The Abnormal are, eggs without yolks; and masses composed of concentric layers, of a more or less membranous character. The texture and thickness of these layers is by no means uniform. (See Preparations in Museum of Comparative Anatomy.)

and the remark will apply to a plurality of calculi in other cavities also—their form is modified by their mutual contact, and their opposed surfaces sometimes appear worn by attrition. The surface thus produced is not always flat: the one may be convex, the other concave, so as to represent a part of a ball-and-socket joint. Fig. 7. is copied from a specimen of this description. If we make a section through such calculi, we may observe that the appearance of attrition is, in some degree, fallacious; for we may clearly perceive, that, even on the opposed surfaces, deposition has been proceeding, and that the number of layers has been increasing on that part of the calculus, but that they have been *thin* and compact, compared with those situated on other parts of the calculus. (See Fig. 8, and 9.) When a considerable number of calculi exist in a bladder, they are sometimes rounded by mutual contact, like the pebbles on a beach: in other cases, they assume a cubical or polyhedral figure, but more frequently the former. This disposition is strikingly seen in a collection of a hundred and forty-two calculi, removed, at one operation, from the urinary bladder by Sir A. Cooper. This, however, is not the only mode in which a cubical figure may be given to urinary calculi. It sometimes happens, that the elongated processes which I have described as projecting from the surface of calculi, wholly or principally composed of oxalate of lime, are not of equal length on all parts of the calculus. Hence, instead of giving to the general outline of the calculus a spherical figure, they produce one which is angular: and, if I may judge from two specimens in Guy's Collection, this figure is apt to approach very nearly to the cube. This is seen, and well represented, by Fig. 10; but it is more strikingly remarkable in the specimen No. 2138, which has a very regular cubical figure of about two inches in diameter. The section clearly shews that this calculus was originally spherical; and that it assumed its present form by the disproportionate increase at eight opposite points, corresponding to the angles of the cube—the intervening parts of the surface having received such additions as to produce six sides; which, though presenting the ordinary inequalities of mulberry calculi, obviously tend to produce a flat surface.

Some calculi, which towards their circumference are evidently composed of nearly parallel layers, and therefore seem to have been formed by superposition upon a nucleus, are, nevertheless, found to be hollow at the centre. One of this description, represented in Fig. 11, has, externally, rather an irregular figure and surface; but the asperities are rounded off; there is an appearance of minute crystallization on some parts of the surface. The section of this calculus is of a pale, yellowish-brown colour: the texture is, generally, close and compact. Towards the circumference, the parallel layers are very evident. The centre of the calculus is hollow; and the cavity it presents has a very irregular surface, suggesting the idea of a soft mass having been dried, leaving the residuum fissured. The parallel layers, towards the internal surface, are interrupted, as if broken by this process after their deposition. I imagine such calculi must have been formed upon a nucleus almost entirely composed of coagulated blood or fibrin, which becomes but imperfectly penetrated with the urinary salts which compose calculus; and that, although absolute desiccation does not take place, they nevertheless have their solid particles brought together in close approximation and cohesion. Fissures are thus produced, as in the drying of starch; whilst the external portion of the calculus, being originally deposited in a firm compact form, and consisting chiefly of calculous matter, remains unchanged. Such calculi may therefore be compared to the masses of Lias found in the London blue clay, which are of a *nodulous* figure, and of a uniform texture externally; whilst internally they present numerous irregular crystalline veins; which veins are evidently produced by the filling up of internal fissures, produced in the manner above described; namely, the aggregation and cohesion of the solid particles of a once soft mass. They bear, however, a still closer resemblance, in size and figure at least, to some small nodules of carbonate of lime which were found imbedded in a seam of clay, and which were hollow internally. Their irregular internal surface very much resembled that of the calculus figured in the Plate.

When a stone in the bladder has acquired a very large

size, so that for a length of time it must have filled the organ, and rendered it impossible for the urine to collect to any notable quantity, it generally happens that the calculus loses the pyriform shape which the model of the distended bladder naturally presents, and assumes a figure which may be compared to that of an hour-glass; except that the contraction does not take place in the middle, so as to divide the calculus into equal portions: the depression is likewise comparatively slight; and its direction, instead of being vertical to the axis of the calculus, is considerably oblique. The degree of obliquity is nearly the same in all the specimens in which I have observed this peculiarity. Such uniformity evidently points to some cause inherent in the bladder itself; but I confess that I have not been able satisfactorily to account for it. I am not aware of any partial superiority in the contractile fibrous coat of the bladder, in the situation and direction required to produce such a depression. I have thought it possible that the ureters might, in some way or other, be connected with it; either directly, by their action on the bladder; or indirectly, by the stream of fluid which they are pouring into it. As I have never examined a bladder containing such a calculus, I am without facts, either for the confirmation or refutation of this idea. (See Fig. 12.)

Fig. 13. represents a section of a small calculus, which appears to possess a cancellated structure; which it is difficult to account for, either on the principle of crystallization, or of superposition in lamellæ.

Fig. 8

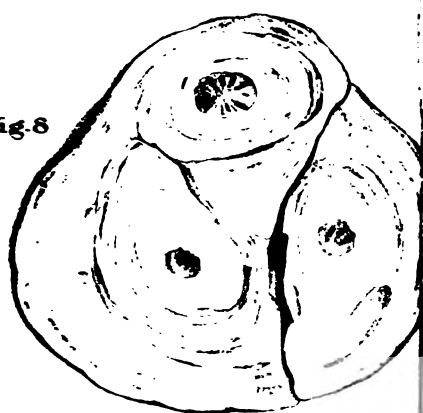


Fig 6



Fig. 5



Fig. 13.

Fig. 11



Fig. 10

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CASES AND OBSERVATIONS
ILLUSTRATIVE OF
DIAGNOSIS
WHERE
TUMORS ARE SITUATED AT THE BASIS
OF
THE BRAIN;
OR WHERE
OTHER PARTS OF THE BRAIN AND SPINAL CORD
SUFFER LESION FROM DISEASE.

BY DR. BRIGHT.

It has occurred to me, within a few years, to witness the symptoms, and, to a certain extent, to watch the progress of two cases, in each of which a tumor had developed itself within the cranium, nearly at the same point; and in which there has been so great a resemblance in the symptoms, as to confirm the feeling which I always entertain, and wish to enforce—that, in disease, as in other matters, there is a fixed relation, which it is possible we may discover between cause and effect;—a belief which is indeed essential, in order to render our investigations on the subject of diagnosis satisfactory and interesting. Of course, various circumstances always exist, which serve to modify, or to form a part of the cause on which certain effects or symptoms depend: and hence arises that difficulty which has induced some almost to doubt the possibility of forming any other than a general and indefinite diagnosis in many diseases, particularly those in which the nervous system is implicated. The only way to overcome this acknowledged difficulty, as regards disease connected with organic change, is, to increase the number of authentic cases, in which symptoms and morbid appearances are faithfully detailed.

In each of the following cases, a tumor has been found just beneath the tentorium, in contact with, or actually

attached to, the petrous portion of the temporal bone, and pressing aside the pons Varolii. This is a part which seems peculiarly liable to injury, owing to the delicate structures in the neighbourhood, and to the proximity of the internal organ of the ear: besides which, the weight of the head is concentrated near this part, so that fractures of the basis not unfrequently pass directly through the portion of the bone which bounds this region of the brain; and when a less degree of violence is done to the parts, it is still probable that the ground-work may be laid for such organic changes as will be exhibited in the two cases which I am now about to detail.

CASE I.

IN Nov. 1831, I was sent for to Woolwich, to see an officer, a tall athletic man, aged 48, who, after being many years in active foreign service, had returned home in 1817. He married in 1825, and had a family. In 1826, he suffered severely from sciatica of the right hip, which he had injured some years before, by a fall from his horse. This was cured by carbonate of iron; and he afterwards enjoyed an excellent state of health, till the autumn of 1829, when, being again engaged in foreign service, he began to experience an attack of periodic pain over the left eye, exactly in the super-orbital notch. This pain used to return about dinner-time, daily; and was always put a stop to before he had half finished his meal. At this time he met with a very severe accident; and was taken up, stunned, and senseless. He was bled; and, after some hours, recovered; but his recollection was, for a day or two, so defective, that he frequently asked what service they were engaged in, and what they were doing; and it was with great difficulty these points could be explained to him. However, in a short time he was tolerably restored; though he never regained the state of health he had enjoyed before his fall, frequently complaining of pains in his head, and of some weakness in his right leg.

About Christmas, he had a severe attack of bilious vomiting; after which, the pains in his head, and over the right eye, were worse, and more frequent; and he experienced, occasionally, a temporary loss of sight, coming over him like

a cloud, and lasting for some minutes; then passing off, and not being followed by any remarkable increase of the headache. After some weeks of suffering, the intermittent pain over the left eye was completely removed in a single day, by taking three doses of sulphate of quinine in rapid succession, two or three hours before the expected diurnal attack; and it never afterwards returned. In June 1830 he had another attack of bilious vomiting, of great severity; which, however, passed off so quickly, that the following day he was able to resume all his duties; but shortly afterwards he discovered, one morning, that the sight of the left eye was completely gone. The sight of the right eye also became imperfect; the weakness of the right leg increased; and the left leg also began to lose power. In 1831, when he returned home, the sight of one eye was entirely lost; and with the other, it was only by great effort, and by changing the field of vision often, that he could discover the features of any one with whom he conversed. The hearing of the right ear was tolerably perfect; but he had, for many years, lost the hearing of the left, from the shock of a gun firing. He likewise complained much of pain darting through his head; which was relieved by cupping, blistering, and tartar-emetic ointment.

At my first visit, on the 8th of November 1831, I found him sitting in his chair by his fire-side, with his eyes closed, perfectly unconscious of surrounding objects; so that I conversed with those in the room just as if he had not been present. His wife made him understand, by speaking close to his ear, that Dr. Parker, the physician who had been in constant attendance upon him, had called: and after a few words had passed between them, I was told that I might now feel his pulse, or examine his eyes, or do what I pleased, as he would suppose it was only the friend to whom he was accustomed: nor had he the slightest knowledge of my having been present, although I remained with him for nearly an hour, during which an incessant conversation was going on. When, after much trouble, by writing words on his hand, and by calling in his ear, and by other means, he was led to comprehend, he answered distinctly, and without hesitation, but in the high-raised and ill-modulated voice

which is usually observed in deaf people. His intellect seemed unimpaired. He was able to stand; but, partly from the weakness of his lower extremities, and still more from the timidity arising from his blindness, he could not move without support; and when he attempted to walk, it was with a short, feeble, tottering step. He had no incontinence of urine, although that had occasionally appeared some weeks before: he had never passed his feces unconsciously, but once or twice there had scarcely been time to prevent an accident of that kind. His sleep was tranquil, and not too heavy; nor did he appear more drowsy than might be expected in a person deprived of sight and hearing. His appetite was good, and had sometimes been excessive. I learnt, that, about a week before, he had experienced a fit, in which he had become insensible for a time, and his countenance suffused, but without convulsion. There was a certain inequality and irregularity in his power of hearing; so that at times he could catch sounds, even slight, but not with sufficient distinctness to connect meanings with the words; nor could he be made to understand, even by the loudest voice.

There was no room to doubt that organic mischief was established within the skull: and all I recommended was, medicine to regulate the action of the bowels, and a few grains of the subcarbonate of ammonia with compound infusion of gentian: his diet to be very plain, and no wine.

Nov. 29th. I again saw him: he seemed more alert, and could hear a little better; so that he had once or twice distinguished that the drum or bugle was sounding, and heard the voices of his children: and although it was a very laborious operation, yet it was possible to make him hear certain words; and, by the occasional assistance of tracing on his hand, words which no effort could make him hear, he was led to comprehend whole sentences; and he then answered correctly, and seemed fully aware of every thing. In this way, his wife, who attended him with most indefatigable care, was able to keep him informed of all that was going on; reading to him the newspapers, in some of the contents of which, particularly as referring to the cholera, then raging at Sunderland, he took great interest. He had

sometimes spoken of a very peculiar sensation in his head, attended with a sound as if grease had been thrown into the fire, making a whizzing noise and then dying away, whilst at the same time a flash of light passed over his eyes. With regard to his sight, that also had experienced some occasional improvement; so that the day before our visit, he had said that he could see his whole hand. He was likewise strong on his legs; for, with support, he could walk three-quarters of a mile. His pulse varied from 70 to 75: his appetite was good, and his sleep calm: his bowels easily acted on by medicine. He was ordered to continue his present remedies as long as they seemed to agree, and afterwards to make trial of the arsenical solution; and to begin at once with a succession of blisters at the nape of the neck and behind his ears. A short time after, a seton was introduced into the nape of his neck.

I afterwards received occasional reports, by which I learnt that the symptoms gradually increased; the sight and hearing becoming, if possible, worse; the paralysis of the lower extremities more confirmed; the bladder and rectum less under controul; and the mental faculties weakened. I had not, however, an opportunity of seeing him again till the 14th of November 1832, nearly a year having elapsed since my last visit. He was now lying on his bed, greatly emaciated, propped up by pillows, with his eyes closed, his hands under the bed-clothes, and his knees bent up. His wife was feeding him with meat, finely minced, and mixed with potatoes: she was obliged to rouse him frequently, to make him take his food; and then he continued to open and close his teeth gently, till he fell asleep, while the meal still remained partly in his mouth. He had no difficulty or choking in deglutition; but for some months he had not seemed to prefer one article of food to another; and he sipped the most nauseous medicine with as much apparent unconcern as he did wine or any pleasant beverage. I understood that he was subject to some changes, and particularly to more or less drowsy days; and this was one of his bad days. About a month before, he had signified some dislike to medicine, which was considered a sign of improvement; but it soon passed away again; and he now seemed

sensible of no difference in the taste of what was put into his mouth. He was quite unconscious of the presence of strangers, and of all that was going on around him. He seemed in a kind of slumber, except when he moved his mouth to eat, or expressed pain, which he did by drawing up his features when the dressings were removed from his foot, upon which two or three oval ulcers had taken place. I learnt that he was generally taken up about one o'clock, and used to sit in his chair till seven o'clock, when he was again put into bed; but he had lost all power of standing; and, although he was perhaps conscious of the calls of nature, he gave no intimation of his wants. He occasionally expressed distinctly severe headache, and a pain over the right eye. I doubt whether the pupils acted at all: the right was rather the larger of the two. He was never observed to be convulsed. Latterly, a few blisters had been applied to the vertex; but it was quite obvious that no relief could be afforded him.

From this time, till his death, which happened on the 27th of December, I did not see him; but I heard that his helplessness had become more and more complete; that he was subject to frequent most profuse perspirations; that the *faeces* and urine often passed unconsciously at the very moment he was taking food; and that the sloughs which were for some time forming upon his sacrum had grown rapidly worse. I witnessed the examination, which took place two days after death, in the presence of Mr. Harris, Mr. Bossy, and his brother, and one or two other medical men.

SECTIO CADAVERIS.—The scalp rather more bloodless than usual. The skull was hard and solid, and somewhat uneven in its thickness: on each side of the sagittal suture internally, but particularly on the left, it had small, deep, irregular cavities, which had been filled with corresponding unusually-enlarged glandulae Pacchioni, which seemed to have almost perforated the skull in some parts, so that only the external table remained. The dura mater was not very vascular; but the projection of the glandular bodies, on each side of the longitudinal sinus, was remarkable; so that, at

first, they suggested the idea of small cerebriform fungous tumors. A small bony plate also, about half an inch in length, lay along the angle of the falx. The longitudinal sinus was quite natural. The dura mater adhered very firmly to the arachnoid, at those parts where the glands were so large; and when it was removed, the arachnoid in the immediate neighbourhood was white and opaque. The arachnoid was not vascular, nor unnaturally adherent to the brain. There was no serum effused beneath it. The depth between the two hemispheres of the cerebrum was small, owing to a considerable elevation of the corpus callosum. The general substance of the brain was natural, but rather deficient in bloody points.

The roof of the ventricles was raised high by clear fluid, of which about four ounces were collected, both the posterior and the anterior portions of the ventricles being distended; but the accumulation appeared greatest in the anterior. A few large vessels, ramified on the internal surfaces of the ventricles, the corpora striata, and the optic thalami, seemed flattened; and the septum lucidum was much thicker and firmer than natural. The choroid plexus, on each side, was exsanguine, and contained several vesicles, from the size of a pin's head to that of a pea. The velum interpositum was also exsanguine.

In attempting to remove the brain from the basis of the skull, it was found that the anterior portion of the cerebellum, on the left side, degenerated into a tumor; and adhered so firmly, that it could not be detached without a scalpel, or employing considerable force, from the petrous portion of the temporal bone. The structure of this tumor was chiefly hard and unyielding, but in some parts softer; and the nervus trigeminus, or fifth nerve, was seen passing over it, flattened and broad: nor did the tumor simply adhere, but the bone had become carious, and pervaded by it, so that a softened cavity occupied a large portion of the petrous ridge, extending towards the sella turcica.

CASE 2.

² NIGHTINGALE WELLS, aged 43, was admitted, under my care into Guy's Hospital, October 22, 1834.

It appeared, that in the year 1817, being then in the army, he received a wound from the bursting of a gun, by which his cheek-bone was much injured, and from that time the sense of hearing became very defective in the left ear; but no other ill consequences were suspected till about eighteen months ago, when an offensive discharge took place from the left ear, which, after continuing for eight months, suddenly stopped about Christmas last. This was quickly followed by a pain across the forehead, and a sense of weight towards the back of the head. About four months ago, the vision of the left eye became imperfect; and in another month, the right eye was likewise affected.

At the time of his admission, the vision of both eyes had, for the last month, been so defective, that he was unable to find his way in the street. During the last six weeks, he had been attacked, three or four times almost every day, with a convulsive agitation, chiefly affecting the left side; and he stated that his memory had become very imperfect respecting recent circumstances, but was more retentive of those of earlier date. His pulse was variable in strength and frequency, generally about 96. He remained under my care nearly three months, during which time a seton was kept open in his neck: his bowels were freely acted upon by various purgatives: a grain of calomel was, for some time, given three times a-day: leeches were several times applied to the temples, and behind the ears: the head was shaved, and a cold embrocation applied. Tartrate of antimony was rubbed into the scalp. All, however, proved, as had been fully anticipated, of little or no avail. The chief variations which took place, during the time he remained, were the occasional recurrence of very severe headaches. He once or twice fell to the ground, in fits of giddiness; and was often unable to move, from what he called the heaviness of his head. He had occasional difficulty in passing his urine; and his bowels were costive. On the 13th of January, he left the Hospital, being at that time totally blind; and never afterwards could distinguish light from darkness. He was quite deaf in the left ear, and the hearing of the right was at times much affected. He had then the perfect use of his limbs; and was in the habit of being led out for walks to a

considerable distance. I was informed by Mr. Thomas Griffith, who, with Mr. Dewsnap, saw him occasionally, and was kind enough to obtain for me what information he could, that this state continued till about the middle of the summer of the same year (1835), when he was suddenly attacked one day while walking in the garden, and fell insensible. "When he recovered," says Mr. Griffith, "he was hemiplegic on the right side, and the mouth was drawn to the left. On the side affected, there was total loss of sensation. He recovered, in some degree, sensation, and the power of motion in the arm and leg; but the effort to use either was always accompanied with violent shaking. He could not stand without support. He at all times had the power of retaining and voiding his feces and urine: the bowels were very torpid, requiring the daily use of full doses of aperient medicine to procure relief. He was subject to convulsive attacks; which came on sometimes three times, sometimes only once a day, and sometimes with an intermission of a day or two. His mind was at times childish, but his reason was not gone: his sense of taste was entirely destroyed: his hearing varied, being some times very good, at others imperfect. Though I had not seen him for many months, he immediately recognised me by my voice. This was about two months before his death: he then articulated with much difficulty: he uttered his words suddenly, and after a prolonged effort. His tongue was drawn forcibly to the roof of his mouth; and in the effort to speak, there was apparently great difficulty to depress the lower jaw: he frequently, however, gaped, and yawned to the full extent. It appeared that the muscles of the right side of the jaw had in a degree regained their power; for the distortion, when I saw him, was in no great degree: sensation, however, was entirely lost on this side of the face. He was a man of irritable temper, and passionate; but I did not observe that he was lately more so than usual." For a considerable time before his death, his arms were so paralyzed, that he could not feed himself; and for the last ten weeks, he could not leave his bed on account of the paralyzed state of his legs.

He died, at his residence at Hammersmith, on the 24th of October 1836; and on the 25th, Mr. Griffith conducted the examination of the body, in the presence of Mr. Dewsnap, Mr. Bowling, and myself; when the following appearances were observed.

SECTIO CADAVERIS.—Raising the calvaria, the dura mater appeared tense, but not remarkably vascular. Two or three large glandulæ Pacchioni stood out on its surface, by the side of the longitudinal sinus, like little fungoid excrescences. When the dura mater was removed, the convolutions appeared flattened, from the profusion of fluid in the ventricles. The arachnoid was not very vascular, and there was no serous effusion.

On cutting into the substance of the brain, there were decided marks of congestion internally, and very distinct mottling. The corpus callosum was a little raised. The ventricles were distended to three times their natural size, by limpid fluid: the parietes and septum lucidum were firm: the foramen of Monro was large and open: one large vessel ran meandering along the under edge of the plexus chorioideus: the plexus itself was exsanguine.

The optic nerves were remarkably small, hard, and of a yellow colour, very different from the pure white by which they are usually distinguished. Their section was oval and compressed. The infundibulum was rather thicker, and of firmer consistence than natural.

Beneath the tentorium, a tumor, as large as a chesnut, was found on the left side, apparently attached by a peduncle to the petrous portion of the temporal bone, pushing aside the tuber annulare and the left hemisphere of the cerebellum, compressing the medulla oblongata, and pushing the fifth nerve upwards. This was found to be a firm dark tumor, the section of which was mottled with grumous blood; and it altogether bore the appearance of a fungoid growth, arising from the cancellated structure of the bone, but closely attached to the anterior portion of the cerebellum. The cancelli of the bone were soft, containing a puriform fluid. The tympanum was quite gone; and the ear contained some purulent matter.

The other viscera, both of the abdomen and chest, were natural; except, that in the lower part of the thorax, on the left side, an empyema of some standing was discovered, with a thick layer of lymph covering the pleura, and circumscribing the disease.

The two cases which I have now detailed afford as many points of similarity as are often found, or indeed as we can well expect to meet with, when we consider the varying combinations which the human frame constantly presents.

In both cases, we have individuals, little past the prime of life, dying in consequence of tumors similarly situated within the skull; and, as they were both in other respects healthy, their symptoms had suffered no important complications from the co-existence of other diseases. In both, we have reason to connect the aggravation, and probably the existence of the disease with the exposures and accidents of military service. In both, the disease has been marked by its gradual progress; has first shewn itself by affections of the senses; and then slowly produced paralysis of motion or sensation in various parts, affecting the intellect little, until an advanced period of the disease, and probably not before it had led to extensive serous effusion into the ventricles.

The symptoms may be more specifically stated; as, an almost total loss of sight, total loss of hearing in one ear, and to a great extent in both, gradual paralysis of the extremities, slight and temporary affection of the sphincters, great diminution in the sense of taste, and a protracted death from sensorial oppression.

In these two cases, the left ear lost its sensibility not much less than twenty years before death; in the one, from the concussion of a cannon; in the other, after a severe wound in the face, and, doubtless, concussion of the temporal bone. What predisposing influence was exercised by the violence inflicted at that time, in either case, it is impossible to say; but the circumstance should not be lost sight of, in the record of facts.

In both cases, the vision was impaired and destroyed, even before the hearing of the right ear; and it is not easy to account for this affection of the sight. I am sorry that I

cannot find any observation after death on the condition of the optic nerves in the first case; and I therefore suppose that no remarkable change was observable in their appearance, or that it was passed over unobserved. In the second case, a very obvious alteration presented itself, the nerves being small, hard, and dark-coloured, with a yellow tint, and, to all appearance, unfitted for the discharge of their natural function; but how this change was induced, whether by pressure on any part of their course, or by interruption to the circulation through their substance, or by the irritation of contiguous parts, or in consequence of the serous effusion taking place in the ventricles, I do not pretend to say. The loss of vision, in both cases, leads us to suppose that it forms an important part of the consecutive history of the disease. The loss of sight in the left eye took place, in each, rather more than two years before death; and the loss of vision in the right eye followed very shortly after that in the left. The left ear, though its power was diminished to a very great extent in both cases, and was entirely lost in the first, retained its faculty of receiving impressions longer than either of the eyes.

The situation of the organic mischief, which might be said, in both cases, to encroach upon the mechanism of the right ear, and which made pressure on the auditory nerve of that side, afforded sufficient explanation of the destruction of its functions; but it is probably to the pressure communicated, through the pons Varolii, to the auditory nerve on the opposite side, as the tumors enlarged, that we may ascribe the slow diminution of sense in the left ear.

With regard to the sense of taste, it seems to have been impaired, in each case, as the disease gradually advanced; and in neither is any specific notice taken of it, till a few months before death. This is one of the most peculiar and interesting symptoms, because one of the least-frequently noticed in cases of cerebral lesion; and I have no doubt that it arose from pressure made by the tumor on the fifth pair of nerves, which gives origin to the gustatory branch; for, in both cases, the fifth pair suffered the most obvious and decided displacement and compression. The obtuseness of the sense displayed itself in the total want of preference with respect

to articles taken into the mouth, as observed in the first case, so that the most nauseous medicines were taken with the same indifference as the most grateful beverages; and, in the second case, the inability to distinguish flavours was freely admitted.

The impaired functions of the senses, more particularly of the sight and hearing, preceded, by a considerable time, any important loss of power in the voluntary muscles, or any diminution in the common sensibility: in regard to which, some slight want of correspondence is observable in the two cases, more particularly as to the spasmodic or convulsive action which occasionally displayed itself in the second case, but was not present in the first. In both cases, however, something analogous to fits of congestive apoplexy occurred, as the irritation and embarrassment of the brain gradually proceeded; and doubtless the serous affection and consequent changes in the ventricles had a considerable share, both in impairing the muscular power, and in inducing that feebleness and oppression of the intellect which formed no part of the disease in its earlier stages.

In connection with the foregoing subject, it is instructive to trace the effects of lesion, as they occur in the different portions descending along the course of the spine; and the opportunities of doing this are frequently afforded us, both by disease, and as the result of accident: and a very interesting paper on this subject, which was read last May, before the Royal Medical and Chirurgical Society, by Sir B. Brodie, is published in the present Volume of their valuable Transactions. Cases of an analogous kind are very frequently occurring in the practice of the physician, where disease has produced partial paralysis, more or less traceable to local derangement. In one case, which was under my care in the Hospital within a few months, a female, somewhat advanced in age, suffered a paralysis of the glosso-pharyngeal and laryngeal nerves, so that she could with great difficulty swallow, and was quite speechless; and, being unable to write, expressed herself entirely by signs; while she had no other symptom of paralysis. A man, who had evident disease in the superior cervical vertebræ, had lost his power

of articulating, except in a whisper; while, at the same time, the lower extremities were paralyzed, so that he was unable to walk; and, although he recovered the use of his extremities in a very great degree, under the use of setons, he left the Hospital still unable to speak above a whisper.

The two following cases afford well-marked examples of a state of parts, unfortunately but too frequent where the ligaments and the articulating surfaces of the two superior cervical vertebræ become diseased; and in which it often happens, that pressure being made by the processus dentatus upon the upper part of the anterior column of the spine, the power of voluntary motion is destroyed throughout the whole trunk and limbs; while the nerves on which the particular senses depend—those from which the motions of the muscles of the face, the tongue, the larynx, and other neighbouring parts are derived—and the nerves of sensation throughout the body, all remain uninjured; and, consequently, the respective functions of the parts are unimpaired.

CASE 3.

Paralysis of Motion, from Pressure made by the Processus Dentatus.

SAMUEL ELOM, aged 52, was admitted under my care, August 13, 1832, having experienced stiffness of the neck for three months; and, after exposure to cold, two months before his admission, first suffered from loss of power in his left hand. Gradually, the right hand also became involved; then the left leg; and then the right leg; so that he now lay or sat in a perfectly helpless state, being only able to move very partially the right leg, which was occasionally raised in a convulsive manner, and the left leg also convulsed more slightly. The sensation was not impaired; the respiration was chiefly carried on by the diaphragm; and when he made a severe effort to cough, his legs were spasmodically drawn up. The muscles of the lower part of the face and the jaws appeared constrained. There was some difficulty in expelling the feces and urine; but he was always able to retain them. He complained of some pain in the throat; and any motion of the head, so as to call either the atlas or the second,

vertebra into motion, produced considerable pain. A seton was immediately inserted in his neck; and he was enjoined the strictest rest, in the recumbent posture: and remedies were given, simply to sustain the functions in a tolerably healthy state; the great object being, to produce anchylosis, if possible, of the superior vertebræ. He now lay upon his back, in a perfect state of helplessness; and was regularly fed by the nurse. He suffered occasionally from severe fits of dyspnœa, which appeared urgently to threaten life; and these were generally relieved by sulphuric æther, and other stimulants.

In the middle of November, he was able to move the fingers of his right hand, which had before been motionless. Towards the end of that month, there was slight motion in the right foot likewise.

Dec. 8, 1832. He could move the whole right arm, and the right leg, pretty well: he could also move the left leg a little.

Feb. 11, 1833. The ribs were now considerably raised in inspiration; and the power both of the hands and the legs was much increased.

28. He had now perceptible motion of the left hand; and, on being taken from his bed, found himself able to step out.

March 19. The seton was renewed in his neck.

April 15. Is able to stand pretty strongly, and take two or three steps. Can raise his hand nearly to his mouth.

May 31. Is able to walk, with the assistance of two men, the whole length of the ward; and back again.

From this time he gradually improved, so that he could walk about without any assistance; and there was every reason to believe, that, except the permanent stiffness of the neck, he would be quite re-established. He still remained in the Hospital, keeping up the discharge from the neck, or renewing it whenever any renewed pain was experienced. He also took occasional doses of calomel and other alteratives. Unfortunately, however, he one day, in the month of February 1834, got out of the Hospital, and drank freely, and had his neck forcibly moved from the position in which it was becoming fixed; the consequence of which was, a relapse, with great additional pain in the part, and much difficulty of deglutition. He again took to his bed, and fell

back into nearly the same state in which he had been at first; and after lingering till April, he died.

Examination after death shewed extensive disease in the superior cervical vertebræ; and an abscess had lately formed, burrowing along the anterior surface of their bodies.

In this case, the effect of disease seems to have been chiefly exerted on the anterior column of the spine and the nerves of motion; first shewing itself in the upper extremities, and then gradually over the whole body. The restoration of the muscular power was likewise progressive, though not, apparently, precisely retracing the steps by which it had been lost. The process of cure occupied a period of eighteen months; and, in all probability, would have been completed before six months more had elapsed; but the imprudence of the patient brought on fresh inflammation and suppuration, under which he sank.

In this case, it is to be observed, that the arms first became the seat of paralysis: and this is by no means uncommon, when the injury is situated in the upper cervical vertebræ. I have, within a short time, dismissed from Cornelius' Ward a patient very greatly relieved by setons and rest, in whom the right arm, and some of the muscles of the neck, were alone implicated in the paralysis occasioned by disease occupying the first, second, and third cervical vertebræ.

The following case, which was lately under my care, and the particulars of which have been collected by my young friend, Mr. Alfred Aspland, illustrates very well the effects of pressure on the anterior column alone, caused by disease in the superior cervical vertebræ.

CASE 4.

Paralysis from Pressure on the Anterior Filaments of the Spinal Marrow.

THOMAS COOK, aged 17, a swarthy lad, of healthy family, admitted into Luke's Ward, under the care of Dr. Bright, Oct. 26, 1836. He has lived in London; and his occupation has been sedentary, chiefly consisting in the rolling of cigars; and his diet has been scanty, poverty preventing him from taking

meat more than once a week: though never robust, he has been free from any particular ailment, till the commencement of the present illness. Fourteen months ago he became the subject of acute rheumatism, preceded by a sudden attack of giddiness, great dimness of vision, and loss of muscular power; to such an extent, that he fell down: there was, however, no loss of consciousness. In the course of half an hour, his vision was perfectly restored, and the other symptoms decreased. In a few hours, both knees were the seat of acute rheumatism: it remained stationary for a month: metastasis then occurred to the neck, the ligaments being particularly involved: there was severe pain in the neck and occipital regions, both internal and external to the scull. In about nine weeks, he was able to leave his bed, and resume his work. His state then was—head slightly twisted to the right side, one of the cervical vertebræ projecting posteriorly; there being numbness at that spot, extending over the scalp at the occiput, and running forwards to the frontal bone. He experienced deep-seated pain in the neck, upon motion, and frequent headache: there was general muscular debility. He continued at work nine months; the contraction of the neck becoming more marked; and the debility increasing to such an extent, that he fell, on several occasions, when walking: the arms were less affected than the legs. A month after his leaving work, he applied for admission to the Hospital. His condition then was: Countenance exsanguine, and appearance unhealthy. He raised his arms with difficulty, but had more power over the right than the left: his walk was feeble, and he occasionally fell: there was a marked projection of the spinous process of the second cervical vertebra, with a good deal of thickening around. The head was twisted to the right side; the chin depressed: over the tumor there was a partial loss of sensation, extending on either side, laterally, for a couple of inches, upwards over the occipital region, and forwards along the sagittal suture towards the frontal bone, where it ceased. He experienced deep-seated pain, upon motion: his respiration was calm, and pulse tolerably natural. He had not noticed any loss of command over the rectum, and passed his water without difficulty: appetite good; digestion properly performed. He was

ordered to have a seton introduced into his neck, and he took sarsaparilla. The seton was inserted just below the numbed part; and excited so much irritation, that it was removed in a few days. From the time of his admission, his loss of power gradually increased; so that in about five weeks he could not raise himself up in bed, and could hardly turn. He frequently suffered from palpitation and dyspnœa, particularly after any exertion; and he began to lose command over the sphincter.

Jan. 1837. Power of motion is now exceedingly limited, being confined to some little in the flexors of the knee-joint, and that only when placed upon his side. His most easy position is, lying on his right side, which takes off the strain from the diseased ligament. When placed in a chair, the head falls on the shoulder, and he cannot move his arms or fingers: when placed in a sitting posture, he cannot support himself in the least. The diaphragm, intercostal, and abdominal muscles, are no longer capable of contraction. The respiration, though regular, and though not in general laboured, is feeble, mainly carried on by the nervus accessorius; the trapezius, and sterno-cleido-mastoideus being called into powerful action. Inspiration, though feeble, is tolerably managed, and under the influence of the will: expiration is passive, and not at all controlled by volition. The phenomena exhibited by the former, as yawning, are present, though rather imperfect: those, on the contrary, caused by the latter, as sneezing and coughing, he cannot execute: he can smile, but cannot laugh: snuff, even in large quantities, does not occasion sneezing, although the desire is intense. During inspiration, the alæ of the nose are widely separated. The number of respirations in the minute averages twenty-two. The vesicular murmur is very deficient, apparently owing to imperfect inflation of the air-cells, as the parietes answer tolerably to percussion. The region of the heart is dull over too large a space, and the impulse is much too forcible. The interval between the two sounds is completely occupied by a loud *bruit de scie*, resembling the air passing through a narrow orifice, most intense at the apex, and audible over the whole chest. The pulse is rather small and vibrating, averaging eighty, some-

what irregular in force and frequency. His appetite and digestion remain unimpaired; but he can with difficulty controul the sphincter for a very short time.

In the month of January, when the influenza was prevalent, he became affected with bronchitis and inflammation of the pericardium, followed by extensive effusion into the chest, under which he sunk, in the middle of March.—Examination after death shewed decided disease in the articulations between the first and second vertebræ, and in the processus dentatus, which was rough on its surface, with a very sharp projection, and encroached considerably on the canal of the spine; and the membranes and ligaments within the canal were thickened and unhealthy. The disease, however, appeared to have been arrested by treatment; and there is no reason to suppose that the result would have been fatal, but for the pericardial inflammation and pleuritic effusion which took place, and of which the results were very strikingly observable after death.

In this case, the disease of the vertebræ has been satisfactorily traced to rheumatism, which is one of the most common causes of the complaint: and there cannot be a doubt that the various interruptions which are observed in the functions of the muscles depend upon the pressure which the different parts of the upper portion of the spine is suffering; while in the two following cases, for the former of which I am indebted to Mr. Aspland's notes, some of the effects of pressure lower down the spine are to be recognised.

CASE 5.

Paralysis, with much Spasmodic Affection of the Lower Extremities, from Disease in the Dorsal Vertebræ.

JAMES CARR, aged 28, an intelligent man, of leuco-phlegmatic temperament, tall, thin, and bony, admitted into Job's Ward, June 1836. He has for some years been engaged as a bookseller's assistant, in London; has always been temperate; and enjoyed good health, with the exception of an attack of acute rheumatism when 16 years of age.

In the pursuit of his business, he was often, particularly at the end of each month, exposed to rain, during the day; and then had to sit up all night in his wet clothes.

After such an exposure, he was attacked with headache, nausea, pain in the left side, and vomiting of bilious matter. The sclerotic became tinged yellow. This lasted for ten days; during which he became weak, and lost flesh. He now experienced rather severe pain about the middle of the dorsal vertebræ, increased by pressure and motion. A blister was applied; and the pain shifted to various parts of the chest, over which blisters were successively applied. He shortly experienced weakness of the lower extremities; so that, in progression, he occasionally fell. He tried Brighton air, but was by no means improved: on the contrary, when he returned home at the end of five weeks, he could with difficulty walk, and sensation was impaired. A tonic plan of treatment was now pursued, under which he improved; so that, nine months from the period of his first attack, he was sufficiently restored to take a situation. Here he was exposed to damp, and was often obliged to take long walks; and in a few weeks, his malady gradually returned. There was debility, and impaired sensation. When lying in bed, there was a constant desire to extend the legs; and they generally, even in walking, had a tendency to cross.

He now entered the Hospital, under the care of Dr. Bright. He could then walk a few steps, with the assistance of a couple of chairs; but even this exertion caused great fatigue, and excessive perspiration. The spinous process of the fifth dorsal vertebra projected: the two next below were depressed and tender, and yielding upon pressure. Below these, sensation imperfect, the numbness extending, in front, nearly up to the umbilicus: abdominal muscles, tense: twitching of the legs, which are drawn up: bowels confined.

Fiat Setaceum reg. dorsi.

Decoct. Aloës co. 3vj. o. m.

Pil. Plum. gr. v. o. n.

During his stay in the Hospital, a period of seven months, he was sometimes better, sometimes worse; constantly tending, however, to an aggravation: sometimes sensation became more perfect: sometimes he could move the legs with greater facility: sometimes there was retention of urine; never incontinence; and he could always command the rectum. The urine was healthy: He left the Hospital

at the commencement of January; and suffered severely from bronchitis, from which he is now recovering.

His present state is, considerable emaciation; complete loss of voluntary motion, and sensation of the legs. Sensation becomes lost at the termination of the lumbar vertebræ, and midway between the posterior spinous process of the ilium and greater trochanter. He has perfect command over his rectum; and readily passes his urine, which is sufficient in quantity, and answers healthily to re-agents. The abdominal muscles in general exhibit a board-like rigidity; but occasionally relax, and then contract sharply, though, upon the whole, more deliberately than formerly. Bending the body forwards, or exertion of any kind, has a tendency to increase this. Getting him out of bed brings on repeated spasms, attended with pain; and a hurried and laborious respiration, with a jerking expiration. The legs, when he is in the recumbent posture, are generally extended and crossed: the rectus and adductors, which, from his emaciation, are easily seen, become remarkably tense: the legs are, however, occasionally drawn up: and when he is placed in a chair, they are generally, at first, extended, and then flexed and crossed; the tendons of the semitendinosi and membranosii, forming the inner hamstrings, presenting very tense cords, contrasting with those of the outer, which are supple. The rectus femoris and adductors rigid, at all times. There is a healing ulcer on the sacrum. His arms are unaffected: he perspires much, particularly from the back of the hands; and though rather irritable, has tolerably good spirits.

CASE 6.

Paralysis of the Abdominal Muscles and Lower Extremities, from Disease of the Third Dorsal Vertebra.

FEB. 21, 1833, I was requested to see a young man, with Mr. Key, who laboured under diminished power in the lower extremities, with great weakness in the hips, knees, and ankles; and a decided diminution of the sensibility on the outside of both thighs and legs, and the nates, as high as the top of the sacrum. He expressed himself as not feeling the earth on which he stood. On one occasion,

within the last two days, the bladder had suddenly emptied itself, without giving any time for preparation. He felt, when waking in the morning, a singular and irresistible desire to yawn, and draw up the legs and arms also convulsively. There was no noise in the head; no deafness, or defect of sight; but on two or three occasions, within the last five weeks, he had experienced slight vertigo. There was no pain in the spine, either when pressure was made or without it; and there was no inequality or irregularity detected in the spinous processes, although the most careful examination was instituted several times.

On Feb. 28th, the paralysis was so much increased, that he was scarcely able to walk, or even to stand. The abdominal muscles were paralyzed, so that he was unable to expel the feces; while at the same time, owing to relaxation of the sphincter ani, they sometimes escaped unawares. The spasm experienced, on waking in the morning, was much more severe: it occurred likewise at other times, and was described by the patient as tetanic. Up to this time he had taken sarsaparilla largely; had been cupped on the loins; and blisters had been applied on each side of the spine. It was now thought right to try the effect of a mercurial; and the combination of calomel, antimony, and opium, was determined on.

March 8. He was decidedly worse; was quite incapable of giving the least motion to either leg; and the sensibility of both was much diminished. His bowels would not act without purgatives; but he had no command of the sphincter ani; and the urine was daily drawn off by the catheter. Slight mercurial action had been kept up for some days.

The mercury was continued till the 15th; when, on account of its disagreeing, it was omitted. The nates and hips began to slough most extensively; and every part, where pressure was made, inflamed and vesicated; although he was totally unconscious of this, not being made aware of it by any painful sensation. At this period he derived the greatest advantage from the use of the water-bed, the most extensive and deep sloughs healing in a very short time.

During the summer, it was first distinctly ascertained that the third dorsal vertebra projected irregularly from the

spine; and this continued to increase, in spite of all the means employed.

In October, a grating sensation was distinctly felt at the situation of the projection. He passed his stools unconsciously, and had no feeling whatever below the waist. His general health was, however, good; and his mind was always cheerful and unembarrassed; and he amused himself constantly by reading.

In December, he passed several small calculi; and others could be distinctly felt in the bladder. The symptoms remained, with very little alteration, during many months; and in the middle of Nov. 1834, the severe spasmodic contraction of the legs had ceased, apparently from more complete disorganization in the spinal canal. In December of that year, his health became greatly deranged: his appetite was lost, and frequent vomiting occurred. Sloughs now recurred upon the nates: his strength diminished from day to day; and on the last day of January he expired.

The foregoing case might, perhaps, be considered as presenting no features of novelty; but it derived considerable interest from the difficulty which occurred in deciding upon the positive seat of injury: for, at the time of his first requesting a consultation, a portion of the right frontal bone was in a state of exfoliation, as the result of periosteal disease; and we distinctly ascertained that giddiness had several times occurred before the paralysis of the lower extremities was well marked. The chief symptoms, however, were entirely confined to the lower portions of the body, but it was many months before the disease of the spine was placed beyond a doubt.

Although it will appear most obvious to us all, when we reflect upon the distribution of the nerves, and their ascertained functions, that results, such as those which have just now been mentioned, must almost necessarily follow injuries inflicted on particular parts of the nervous system, yet the positive proofs to be derived from the effects of disease cannot be too frequently repeated, or too carefully accumulated; and the more we habituate ourselves to connect the

symptoms with the nature and locality of the lesion as affecting those parts about the basis of the brain and the spinal cord—the influence of which, upon distant parts, is obvious and demonstrable—the more confidently shall we learn to seek for similar connections in parts where they have not hitherto been so plainly discovered; and the more likely we shall be, not only to trace out the physical dependence of parts, but likewise to arrive at whatever conclusions the intricate subject will admit of, in reference to the dependence of the mental processes and deficiencies on the integrity or lesions of certain portions of the cerebral structure. Thus, a vessel is ruptured on the surface of the brain, or in the substance of one of the hemispheres; apoplexy is the result, followed by hemiplegia; a certain vacuity of mind remains, but the defect is general, or unattended by any marked peculiarity. In some cases, however, there is something more specific: in some, very peculiar spectral illusions have been the result: in other cases, defective articulation has been remarkable: again, in another case, the memory has been most strikingly defective: in some cases, this defect has been general: in some, it refers only to the use of language: while in others, a great and marked difficulty has been observable in the power of connecting words with the objects and ideas they are intended to express. It is not unreasonable to suppose, that, in these different cases, the lesion has differed, either in its character or its situation; and the more facts we can bring to bear, though they bear but slightly or doubtfully on the point, the more likely are we to arrive at just conclusions; provided we do our best not to draw our inferences too rapidly, or give more than the proper weight to the connections we are anxious to establish between causes and effects.

The three following cases bear particularly on those partial lesions of the brain to which I have just referred.

CASE 7.

Difficulty of Articulation, and of connecting words with their corresponding ideas.—Lesion in the Corpus Striatum.

SARAH DODDS, a single woman, aged 30, rather short, and of a slight make, was admitted, under my care, into Guy's

Hospital, the subject of hemiplegia of the right side, not affecting the muscles of the face. Her articulation was exceedingly imperfect; but the most remarkable circumstance in her condition was, the total inability of connecting her words, when she could utter them, with the ideas she wished to express, or the things to which she meant to refer. It appeared, that, for the last three or four years, she had suffered much from dyspeptic attacks, frequent and long-continued headache, superficial pain at the occiput, some deafness and ringing in the ears. Six months before she was seized with the attack, which terminated in hemiplegia, all these symptoms were aggravated; the pains in the head became more darting; the deafness more confirmed; the superficial pain at the occiput worse; her memory became impaired; she complained of peculiar sensations in the head, something between giddiness and faintness, and she imagined she was going to fall; and her hands, but more particularly the right, were apt to become cold, and rather numb. These ailments all gradually increased, so that she was obliged to forego domestic employments; and in the middle of June 1836, after having experienced odd sensations and a peculiar dryness in the mouth during the day, she had an apoplectic seizure while undressing herself to go to bed. She remained in a state of coma for forty-eight hours, with her eyes fixed, breathing stertorous, and frequent vomiting of bilious matter, so that her medical attendant thought she was labouring under the effects of a narcotic poison. At the end of the period mentioned, she recognised surrounding objects; but her memory was much impaired, her power of articulation quite destroyed, and the right side paralytic, with much deficiency of warmth. At the end of a fortnight, she could articulate 'Yes' and 'No'; and at this time it was that she was admitted into the Hospital. She was soon put upon a very gently-tonic plan of treatment; and, under this, improved in intelligence, articulation, and the power of motion; but still the peculiar difficulty of connecting words and things was observable. When asked, for instance, the name of her hand, at which I pointed, she said, "A pin"; but immediately signified her knowledge that this was not the right word, though she could not tell

what the right name was. On the 23d of September, at her own particular desire, she was permitted to have electricity, in the form of slight shocks and sparks, applied to the affected side, and her improvement seemed to be still further hastened under the use of this remedy; and, by the 1st of October, I noted her speech and articulation to be almost perfect, and that she connected words with ideas much better. She continued gradually to improve, and was able to walk, though with much effort, without a stick, along the whole ward. Her right hand, however, scarcely recovered at all, but remained stiff, with the fingers semi-flexed. Her powers varied; but in her best days she spoke like a foreigner, considering all her words, and not unfrequently mistaking them.

On the morning of the 24th of October, she complained of a recurrence of the odd sensations and dryness of the fauces which had ushered in the former attack, leading her to fear a second; and in the afternoon, while walking up the ward, she fell in a fit, striking her face violently against an iron bedstead. When raised, she said, in a feeble voice, she was unhurt. She was laid in the horizontal posture, and almost immediately became comatose. Six ounces of blood were taken, by cupping, from her neck. Dr. Addison saw her an hour after: her state then was entire coma, face not drawn to one side, left pupil contracted, right dilated, neither answering to the stimulus of light; breathing stertorous; pulse slow, and somewhat feeble. As there was a very peculiar fulness of the abdomen, quite at its lower part, a catheter was introduced, and about a pint of high-coloured urine was drawn off. She sunk in about three hours after the attack, without any return of consciousness, and without convulsion.

SECTIO CADAVERIS.—Raising the calvaria and dura mater, the convolutions were seen compressed; and a fluid could at once be felt in the right hemisphere. Cutting into this hemisphere, it was found that a large portion of the cerebral matter was broken down and softened. There was an extensive yellow-ochery cell, shewing the situation of the injury which had attended the first apoplectic seizure; and this

seemed to occupy the corpus striatum in all its extent, more particularly the posterior part, where it was surrounded by a thin fibrinous cyst, and contained a little brownish-yellow clot. The fatal attack seemed to have originated near the same part; to have burst, through softened brain, into the left lateral ventricle; completely destroyed the septum lucidum; filled the opposite ventricle; found its way into the third and fourth ventricle; and insinuated itself into the cerebellum; in the left hemisphere of which was a clot as large as a walnut, like black-currant jelly; while the blood lay in layers between the plates of the cerebellum, and formed an extensive ecchymosis under the arachnoid. The arteries were generally a little thickened, and spotted with atheromatous matter, evidently tending to ossification. The vertebral arteries were dilated.

Chest contracted: lungs turgid, and considerably infiltrated with frothy serum.

Heart—left ventricle hypertrophized, much contracted, containing no blood: there were opaque spots in various parts of the surface: the mitral and aortic valves slightly thickened: ascending aorta rather dilated; descending, small; the coats thickened and rigid: the right ventricle not thickened, but of limited capacity.

Spleen, rounded, dark, and fleshy.

Stomach, remarkably large, and thick in its coats; and descending almost into the pelvis.

Uterus, small: a cyst the size of an egg in one ovary.

In this case, the situation of the cerebral lesion left by the first attack was well defined; and, from its situation in the posterior part of the cerebral portion of the brain, it corresponded well with the opinion now pretty confidently received by many observers, that lesions of this portion are connected with a diminution of power in the arm; while its occupying chiefly the posterior part of the corpus striatum is further in accordance with an impression I have received from observation, and inculcated, with regard to the lesions which influence the articulation. As to the connection of this particular lesion, and the peculiar mental difficulty, we can only say, that, as far as we can judge, the injury done

to the corpus striatum corresponded, in point of time, with the commencement of the mental affection; and the mind was gradually regaining its power of associating words and ideas, while a process of gradual reparation was taking place in the lacerated brain. The disease, both of the heart and the arterial system generally, and of the arteries of the brain, undoubtedly concurred to produce the rupture of vessels on which both attacks depended; and probably the superficial pains about the occipital region were indicative of the diseased condition of the vertebral arteries.

CASE 8.

Difficulty of connecting Words with their corresponding Ideas.

IN June 1832, I was requested by Mr. Beck, of Lambeth, to meet him in the case of a gentleman of stout make, and past the middle age, who had always enjoyed good health, except that he had been subject to occasional headaches, now and then attended by sickness. Several years ago he suffered from distressing drowsiness; and, on one occasion, experienced a decided fit in the street, where he was picked up senseless, and recovered under active bleeding. Since that time, it was not known that he had any return of such an attack.

The first symptoms of the present illness had shewn themselves on the day before I was called; when he complained of headache; and a friend, calling on him, was surprised at a singular incoherence in his speech. A brisk cathartic was administered; but no material change had taken place when I arrived. I found him, apparently, quite bewildered, and talking most incoherently, but it was manifest that this arose from an inability to collect his words so as to make them the representatives of his ideas, coupled with some slight difficulty of articulation. There was no intolerance of light or sound. The pupils acted well. Pulse 62. Respiration tranquil. The only mark of paralysis was a slight drawing of the mouth to the left side. The great and striking peculiarity was the difficulty of bringing the right words into play, when he spoke. He evidently knew those who came into his room; offering his hand cordially to his friends, but calling them by wrong names, and accompanying the action

by some expression or words which were most foreign to the friendly greeting which his manner plainly signified.

It will not be necessary to enter particularly into the treatment adopted. Moderate depletion by bleeding, free purging, local application to the head, and divided doses of mercurials, were amongst the means employed.

On the 9th, I reported: "He sleeps very composedly. Pulse 80; varying much in point of strength; sometimes firm, and at others faltering. Tongue clean. Bowels confined. The blister has risen most completely over the whole scalp. The peculiar state of mind remains unaltered; and the following may be considered a specimen of his conversation. "How do you do, sir, to-day? Yes, I told you so, "about half-past twelve. But how are you, sir? Yes, yes, I "know, half-past; well, perhaps a quarter. You see ten and "ten; yes, that is it. Did you eat a good dinner to-day? "About that you know I said. No, that's too much—You "do that too much"—and so on, without a connected idea. But all said with an air of the greatest good humour and cheerfulness.

July 12. His general condition decidedly improved, but his conversation unintelligible to a great degree. He knew me; held out his hand to me; but called me by a wrong name; saying he would introduce me "to a nice little boy (a little girl of five years of age, of whom he was very fond, entering the room), Mr. D——, (meaning the little girl, whose name it really was): let me introduce you to Mr. D—— (meaning me). A nice little pony, is not she?"

July 15. He rose to meet me; shook me by the hand; but said he could not pronounce my name—did not know it. I shewed him my card, and he read it with a kind of triumphant air. "'Bright':—yes, you see I know it:—now, it is so odd," said he, laughing, "I cannot say what I want! I know all your names so well!" I asked him to read the address on my card: "Yes, I know both the words very well, 'Hanwell,' 'Surfit.' How strange it is I cannot say it!" I then read it slowly; and he repeated it distinctly, laughing with great good humour at his own stupidity.

July 28. Still improving in his manner and articulation, though he still has frequent difficulty in finding the word he

wants: but is always aware when he uses the wrong word.

August 11. He was so much better, that I took my leave of him; although he still had a little hesitation; and frequently, when speaking quick, was at a great loss for his words.

This gentleman has been living a quiet retired life from that time, and has had no return of his disease; but for full two years after his attack, traces of the malady were discernible in the mode of his articulation and speech.

Of course, it is not possible to speak positively respecting the exact nature of the cerebral affection in this case: it might very possibly never have gone on to the actual extravasation of blood; and I was inclined to look upon the attack, from the first, rather in the light of congestive epilepsy, with diseased vessels, than as attended by rupture and effusion: still, however, that some portion of the brain suffered in a very peculiar manner, I do not think a doubt can well arise; and the probability appears to me, that the same part of the corpus striatum which had been injured in the last case had also, under some different modifications, involving the mind more, and the voluntary motion less, become the seat of derangement; perhaps depending on the congestive distension of the cerebral arteries.

CASE 9.—Deranged Vision, and Sense of Touch, with Lesion of the Optic Thalamus.

IN October 1835, I was requested by Mr. Travers to see a gentleman, aged 58, of gouty predisposition, who had for some time been the subject of cerebral symptoms. These commenced exactly a year before; at which time, while sitting after dinner, he experienced a slight vertigo; and having risen from his chair, fell to the ground in trying to regain it. This attack left him with numbness in the whole of his left side, for several weeks. Two months after, he had another attack; which was followed by a very peculiar morbid sensation in his fingers, so that every thing he took hold of felt as if it were gelatinous or unctuous; and when he touched his bed-clothes, it was difficult to persuade him that arrow-root had not been spilt over them. This lasted for a short

period, not many hours, and was succeeded by several optical delusions: he fancied he saw persons in the room, and that, as he walked the floor, he had to step over gates and stiles and railings, and his mode of stepping corresponded with this conviction; at the same time, he was capable of transacting business, so that the illusion appeared most probably to arise from some morbid impression on the optic nerve, and not from a mental process. For the last few weeks, he had experienced a dull pain over his ears, and had occasionally heard very indistinctly; and a few days ago, suffered, for a few hours, an almost total loss of sight; and was, at the same time, unable to comprehend what was read to him; and a tingling sensation was now always felt in his left leg and thigh. It was our opinion, at this time, that disease was taking place in the vessels of the brain; and we anticipated more serious mischief, and more severe paralytic attacks. A seton in the neck, and strict attention to the condition of the bowels and to the diet, were the means to which we chiefly looked for averting the threatened danger.

I saw this gentleman three or four times only. The last time was in Dec. 1835; when, though he had refused to employ the seton, he considered his health much improved. I afterwards heard that, in the middle of the summer, he was attacked with intense pain in the right hypochondrium, the exact nature of which was somewhat obscure; but severe inflammatory symptoms coming on, he sunk in the latter end of October 1836.

The following is a report, drawn up by Mr. B. Travers, junior, of the appearances presented in the brain:—"The sinuses much loaded: tunica arachnoides opaque, thickened, and raised by serous fluid, which flowed in considerable quantity on removing the brain, gravitating towards the basis cranii and vertebral canal. Medullary structure unusually soft and vascular. On making a section of the posterior part of the right thalamus nervi optici (corpus geniculatum inferius), a chink or cell, half an inch in length, was detected on its surface, presenting a dusky yellow tinge, as though stained with bile; and there was increased softening of the surrounding medullary substance. Half an ounce

of fluid in the right lateral ventricle: none in the left. The cerebral arteries were large and patulous, exhibiting occasional traces of atheromatous deposit."

The immediate cause of death was found to be a large peritoneal abscess, attended with general peritonitis.

In this case, the more remarkable symptoms displayed themselves in connection with the vision, and the sense of touch, as exercised by the fingers; and the lesion of the brain was most decided in the optic thalamus; corresponding, therefore, with our preconceived notions of the influence exerted by this portion of the brain.

When we review the cases which I have thus thrown together, I trust that, in one point, the connection between them will be obvious; inasmuch as they all serve, more or less, to establish and keep up our conviction, that the symptoms which arise in cerebral and spinal disease are actually the results, and therefore the fair representatives, of the lesions which the different portions of the nervous system have suffered.

In the two first cases, the dependence of the symptoms upon the lesion seems well made out. In the two cases of cervical, and the two cases of dorsal disease, the evidence is scarcely more to be denied: and if, in the three last cases, more uncertainty prevails, they may still stand as recorded facts, illustrating some curious, though not very uncommon forms of disease; while the two in which the brain was examined have the still further value of shewing the coincidence, if not the dependence, of certain very clearly-defined lesions, and certain well-marked symptoms.

OBSERVATIONS
ON THE
GANGLIONIC ENLARGEMENT
OF THE
PNEUMO-GASTRIC NERVE;

THE PROBABLE FUNCTION OF THAT GANGLION;
AND THE POSITION WHICH IT OCCUPIES IN THE HUMAN SUBJECT
AND IN SEVERAL OF THE LOWER ANIMALS.

BY MR. EDWARD COCK.

I HAVE been induced to draw up the details of this Paper in consequence of a communication received a short time ago from Sir Astley Cooper. It will be seen, that I have attempted nothing more than to follow out his views on the subject, and to enlarge somewhat on a discovery which is exclusively his own; and which will be best understood by quoting his words, as addressed to me in the following letter, which was accompanied by a preparation.

" MY DEAR EDWARD,

" April 18, 1837.

" I have sent you the *superior laryngeal ganglion* of a rabbit, which I found last year (February 1836), whilst making the experiments I have published in the Guy's Hospital Reports on the Compression of the Carotid and Vertebral Arteries. I always thought it an objection to my friend Sir Charles Bell's opinion of the ganglia giving sensibility, that the laryngeal nerve, going as it does to parts of the most sensitive description, was not ganglionic. It gave me much pleasure to find this ganglion. If you put the nerve in water for five minutes, you will see the usual colour of a ganglion in the enlarged part from which the laryngeal nerve springs.

" Yours affectionately,

" ASTLEY COOPER."

In almost every work on descriptive human anatomy, mention is made of the peculiar appearance presented by the pneumo-gastric nerve, and of the slight enlargement which it experiences at the external base of the scull, just as it is leaving the foramen lacerum. This enlargement is variously, but at the same time very slightly, alluded to by different anatomists. Many have noticed the rounded, bulbous, and plexiform appearance of the nerve at that part, likewise its grey colour: some speak of it as a condensation and thickening of the nervous fibres, in which the surrounding cellular tissue is much implicated: others seem to consider it as the point where the connexion takes place between the pneumo-gastric and the surrounding nerves. It has been called a ganglionic enlargement, but without any peculiar meaning being attached to the term. No one appears to have particularly examined or described the precise anatomical nature and appearance of this ganglion, or to have assigned to it any peculiar physiological function. I am not aware that any attempt has been made to prove that it is either a ganglion *sui generis*, or that it bears an analogy to the ganglia of other nerves*. The difficulty of exposing the nerves as they issue from the foramen lacerum—of disentangling and extricating their filaments from the sheath and the surrounding cellular tissue in which they are involved; the uncertainty which exists with regard to the precise origin of the par vagum—how far it may be considered as belonging to a separate system, and how far it possesses functions, in common with the spinal nerves, of motion and sensation; perhaps, in some measure, account for the little notice which appears to have been taken of the ganglionic enlargement in question. That a peculiarity does exist in the texture of the nerve at that part, seems to be generally admitted; but the explanation of this peculiarity seems to have been purposely slurred over, or altogether omitted, by the anatomist and physiologist.

The pneumo-gastric is now usually considered to form

* It is but justice towards an anatomist who, for indefatigable research and fidelity of description, stands unrivalled, to observe, that Meckel, in his *Descriptive Anatomy*, has given a very accurate account of the ganglion in the human subject.

part of a separate class of nerves presiding over the functions of respiration, deglutition, and digestion; and the origin of this set, or the centre of their nervous influence, has been referred to the cineritious matter of the olivary bodies*. If, however, we examine the distribution of the par vagum, it will surely be admitted that some portion of the nerve exercises a function of voluntary motion and common sensation, precisely analogous to that of the spinal nerves. I more particularly allude to those branches which supply the larynx; viz. the superior and recurrent laryngeal. The latter of these is principally distributed to the muscles of the larynx, and is therefore a nerve of motion; while the former, although it furnishes some slender muscular filaments, is almost entirely devoted to the mucous membrane, covering the epiglottis and lining the sides of the cavity: it is therefore a nerve of sensation†. Let us now direct our attention to the origin of the par vagum, or rather to the spot where it leaves the surface of the medulla oblongata; and we shall find, that the nervous fibrillæ which compose it come off in close apposition; on the one hand, with the corpora restiformia, or common sensory columns of the spinal cord; and on the other, with those fibres of the corpora pyramidalia, or anterior motor columns, which Mr. Solly has traced, and described, as passing into the cerebellum: so that, besides the origin which the pneumo-

* It is not my intention to raise objections on either of these points; although the respiratory system, as laid down by Sir Charles Bell, involves many physiological discrepancies; while, on the other hand, the centre or origin of the nerves of respiration still continues to be a subject for speculation and inquiry. Nevertheless, the classification may be received as a judicious and useful arrangement; and the anatomy, which refers the origin of the par vagum to the corpora olivaria, is probably correct with regard to the greater portion of the nerve.

† The distribution of the laryngeal nerves is, I believe, incorrectly given in all anatomical works. My colleague, Mr. Hilton, has lately taken much pains in the investigation of this subject; and the result of his dissections shew that the superior laryngeal nerve (after it has pierced the thyro-hyoideal ligament) gives off no muscular filaments whatever, but is entirely distributed to the mucous membrane. The crico-thyroideus is, therefore, the only laryngeal muscle supplied by it in the human subject; and in some animals, the crico-thyroidean twig will be found to arise, not from the superior laryngeal, but from the trunk of the pneumo-gastric itself. All the proper muscles of the larynx, with the exception of that just mentioned, receive their nerves from the recurrent branch alone.

gastric is supposed to derive from the olivary bodies, comprising, no doubt, the greater portion of the nerve, and constituting its specific character, it likewise possesses every facility of position for deriving fibres from the anterior and posterior columns, or the motor and sensory tracks of the medulla spinalis. It may, perhaps, admit of some dispute, whether the laryngeal muscles, and the recurrent nerve supplying them, are to be considered as voluntary, in the strictest sense of the term; and their action may possibly be modified by the influence of the sympathetic: but the nature and function of the superior laryngeal nerve can hardly be mistaken. The exquisite sensibility of the mucous membrane at the entrance of the larynx at once stamps the character of the nervous filaments which supply it: we recognise them as nerves of common sensation, performing a duty similar to that exercised by the twigs of the fifth pair supplying the conjunctiva, the membrane of the nose, the external auditory passage and membrana tympani; all of which, as well indeed as the cutaneous nerves distributed over the whole surface of the body, derive their origin from the same medullary track, and belong to the same class as regards their function. They constitute the safeguards—the sentinels to the animal frame, the intelligencers of approaching mischief; and they severally impart a degree of sensibility, more or less exquisite, in proportion to the importance of the organ over which they keep watch, and its liability to external injury.

We may, therefore, consider the superior laryngeal branch of the par vagum as a nerve of common sensation; and we may fairly infer, that, with the exception of the few muscular filaments it contains, it is derived from the sensory column of the spinal cord; in fact, that it is analogous to the posterior roots of the spinal nerves; and that the ganglion which forms the subject of this paper is the ganglion belonging and appended to the sensory portion of the par vagum, or, in other words, as Sir Astley has described it, “the ganglion of the superior laryngeal branch*.”

* This expression appears to me to require a little modification, or rather explanation. The name by which Sir Astley has designated the ganglion is at once correct and judicious, inasmuch as the laryngeal branch is derived from the ganglion itself; but at the same time it seems to be too exclusive

The dissections which I have made on various animals all tend to confirm the accuracy of the opinion entertained by Sir Astley Cooper respecting the nature and function of this ganglion; viz. that it forms one of that class of ganglia which appear to be necessary appendages to all nerves of common sensation; and that it belongs more particularly to the superior laryngeal nerve, which indeed is the only branch of the par vagum which we can positively identify as exercising a purely sensitive function†. The

exclusive in its signification, as restricting the use of the ganglion to that nerve alone: whereas, from the dissections I have made, I have every reason to believe that the ganglion does not belong exclusively to the laryngeal branch, but extends its influence to numerous other filaments included in the trunk of the par vagum, and affording to the lungs, to the pharynx, œsophagus, and stomach, that faint but peculiar sensibility which they appear to possess—filaments which impart to the stomach the sensation of fulness when that organ has been distended with food; to the lungs, the “*besoin de respirer*,” and the sensory functions necessary for respiration alluded to by Bichat. In the sheep, where I was enabled to unravel the fibres of which the par vagum is composed, and trace with considerable accuracy their course and their connexion with the ganglion, I found the following arrangements to exist:—The pneumo-gastric trunk, as it left the base of the scull, might be said to consist of two orders or sets of filaments; viz. the ganglionic, and the ganglionless. The former terminated in the ganglion, where their fibrous character became lost after the manner of the posterior roots of the spinal nerves: the latter were continued downwards beyond the ganglion, having merely a cellular connexion with it, and resembled in this respect the motor portion of the fifth pair. Lastly, from the ganglion arose two sets of nerves: the one constituted the laryngeal; the other joined the ganglionless filaments mentioned above, and formed part of the trunk of the par vagum, descending to the chest. A careful dissection will bring to light a similar arrangement in the human subject, the horse, the ass, and probably in other animals. (*Vide* Diagrams 5, 6, 7.) I may also observe, that the laryngeal nerve appeared to derive some very minute fibrillæ from the pneumo-gastric trunk above the ganglion. These might be either specific respiratory filaments, or motor-muscular filaments, perhaps both.

† The resemblance between the ganglia on the posterior roots of the spinal nerves and the pneumo-gastric ganglion did not escape the observation of Meckel. He seems, indeed, to have considered the pneumo-gastric, glosso-pharyngeal, and accessory nerves as all derived from the posterior spinal columns; and thus constituting a posterior root, which, on its exit from the cranium, is joined by the lingual nerve from the anterior columns;—the combination of the four nerves thus forming a trunk, which, in its origin, composition, and function, is analogous to a spinal nerve. This view of the subject can, I think, hardly be maintained; as it is much more in accordance

first of these positions is supported by the circumstance, that this ganglion, both in colour and texture, exactly resembles those on the posterior roots of the spinal nerves: the latter position is proved by the fact, that in the larger animals, where the tissues admit of a more easy and accurate examination, the laryngeal branch may be seen to come off distinctly from the ganglion, and that the position of the latter varies according to the origin of the nerve. Thus, in the human subject, the ganglion is situated immediately at the base of the skull; and it is there that the laryngeal nerve is sent off. In the rabbit, the ganglion, and consequently the point where the laryngeal branch is detached from the pneumo-gastric trunk, will be found much lower down, or nearly in a line with the upper edge of the thyroid cartilage. In the dog, the ganglion is placed close to the lacerated opening, whence the laryngeal nerve descends very obliquely: in the ass, the latter is given off below the level of the larynx, and ascends to pierce the thyroid cartilage.

The shape of the ganglion presents great varieties in different animals. In the dog, cat, rabbit, and rat, it is rounded and bulbous, projects considerably from the pneumo-gastric trunk, and is immediately recognised on laying bare the nerve.

In the human subject, in the horse, the ass, and the sheep, it is more or less elongated or spindle-shaped; and is in great measure concealed by nervous fibrillæ, which pass over its surface without being connected to it; and which must be turned to one side, before the body can be distinctly brought into view. Generally speaking, the length of the ganglion will be found to bear a certain proportion to the length of the neck of the animal; and the varieties of shape and position which it assumes in different animals has probably no other object than to adapt it more conveniently to the surrounding parts.

accordance both with anatomy and physiology to suppose that the three first nerves contain motor as well as sentient fibres.

Mr. Solly, in his work on the Brain, has expressed himself in favour of this latter opinion.

Fig 1.

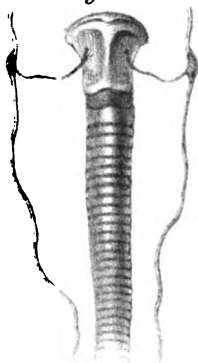


Fig 2.

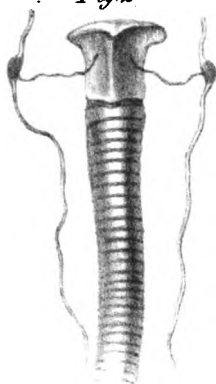


Fig 3.



Fig 4.



Fig 5.

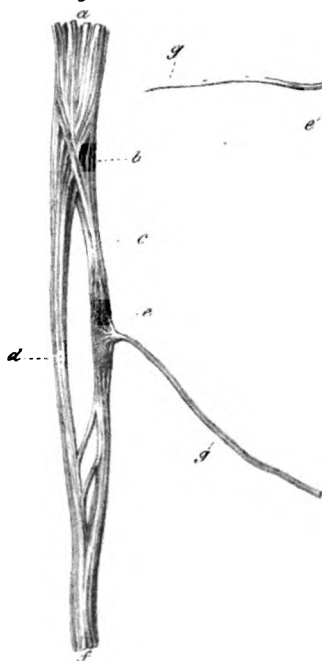
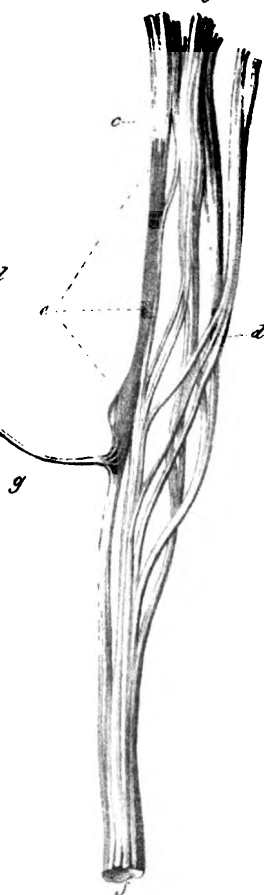


Fig 7.



Fig 6.



In the Plate which accompanies this paper will be found diagrams of the more remarkable diversities of form which the ganglion presents in different animals. In some of the examples, the fibrillæ of the pneumo-gastric trunk have been unravelled, and separated, to exhibit the partial connexion of the ganglion with the nerve.

As far as my observations have carried me, the glosso-pharyngeal nerve appears to be furnished with a ganglion, in all respects similar to that which has formed the subject of this paper.

EXPLANATION OF THE PLATE.

Fig. 1. represents the pneumo-gastric nerves of the rabbit, with the ganglionic enlargement and the superior laryngeal nerve of either side, arising from the ganglion, and passing to the larynx.

Fig. 2.—The same in the ferret.

Fig. 3.—The same in the guinea-pig.

Fig. 4.—Pneumo-gastric trunk of the dog, with the ganglion and superior laryngeal branch.

In the three next diagrams, the fibres of the pneumo-gastric trunk have been separated from each other, in order to illustrate their partial connexion with the ganglion.

Fig. 5.—Diagram of the pneumo-gastric nerve in the human subject:—

a The fibrillæ by which the nerve arises from the respiratory track.

b The plexiform appearance produced by the interlacement of these fibrillæ as the nerve is leaving the foramen lacerum; being the spot where its principal junction with the adjacent nerves takes place.

c Ganglionic portion of the pneumo-gastric trunk.

d Ganglionless portion.

e Ganglion.

f Pneumo-gastric trunk below the ganglion; shewing the re-union of the two sets of fibres; viz. those proceeding from the ganglion, and the ganglionless portion.

g The superior laryngeal branch arising from the ganglion.

Fig. 6.—Pneumo-gastric trunk of the ass detached, as it leaves the base of the skull, and unravelled. (The letters refer to the same parts as in

Fig. 5.)

Fig. 7.—The same in the sheep.

OBSERVATIONS AND EXPERIMENTS
ON THE
LUNGS OF NEW-BORN CHILDREN,
IN RELATION TO
MEDICAL JURISPRUDENCE.
BY MR. ALFRED S. TAYLOR.

TH**ERE** are few subjects which demand a greater share of attention, on the part of a medical jurist, than the application of the pulmonary tests in a case of alleged child-murder. Much has already been written and published on the medico-legal relations of Infanticide; but the subject is far from being exhausted. Indeed, the great difference of opinion which prevails among many estimable and accomplished men in the profession, relative to the utility of the hydrostatic test, is a sufficient inducement, to those who are inclined to take the affirmative side of this question, to collect all the cases which may present themselves to their notice, and endeavour to shew in what instances the test may be safely applied, and in what its use should be avoided. Through the kindness of my friend Dr. Ashwell, I have lately had the opportunity of examining the bodies of four new-born children. Two of these cases are somewhat remarkable; but as the facts connected with the birth of each child were known, it is presumed that the two others will also be found in some respects worthy of attention. I shall describe the examination of the subjects in the order in which it appears to me it ought to be conducted, in every investigation relative to child-murder.

CASE I.

What was the age or degree of maturity of the child?

This child was of the male sex. Its body, measured from the vertex to the sole of the foot, was eighteen inches long; and the point at which the umbilical cord was inserted, was just about the centre of its length: the body weighed 33465 grains, i.e. nearly six pounds. The hair on the head was abundant, and about an inch in length. The bones of the cranium were firm, and did not readily overlap each other on compression. The nails were well developed, and reached fully to the extremities of the fingers. The testes had passed into the scrotum. The membranæ pupillares had disappeared. The skin was pale and smooth, presenting no sign of desquamation. Around the neck and shoulders there was a diffused redness. From the whole of these data, we are entitled to draw the inference, that this child was either mature, or very near maturity.

Had the child lived to respire?

The body was full and plump. The chest was narrow, and somewhat flattened anteriorly: on opening it, the cavity was found to be somewhat small and contracted. The thymus gland was large, and of a livid colour. The heart and pericardium were prominent. The lungs were placed so far back in the cavity, as to be scarcely visible: the anterior edges of these organs, which were sharp, alone projected forwards; but they did not reach or overlap the sides of the pericardium. They were of the usual livid or blue colour observed in children which have died without breathing. On firm compression, in every part of their substance, there was not the least sign of crepitation.

As I considered this a very favourable case for the experiment, I resolved to inflate the lungs before removing them. While the cavity of the chest was thus exposed, a bent glass tube was introduced into the mouth, the nostrils were closed, and several moderately-violent efforts were made to inflate the organs, but at first without effect. After five or six strong inflations, bright-coloured insulated patches, almost of a vermilion redness, began to shew themselves; chiefly in the *right* lung, which appeared to receive air much more readily than the left. The anterior and inferior

portions of the lower lobe, with the anterior margin throughout, were the parts which became inflated. The left presented similar patches, principally upon the external surface and lower portion. After each inflation, the lungs slightly collapsed; and although five or six long-continued inflations were made, at least four-fifths of the organs remained undistended. At this time they projected but very little forwards, becoming only somewhat more closely applied to the posterior and lateral parts of the pericardium, but by no means concealing it.

Before removing the lungs from the chest, it was observed that the ductus arteriosus was of equal diameter, from its origin to its junction, with the aorta. Its caliber was such as is usually found in a child which has not breathed. The heart contained a quantity of grumous blood. The foramen ovale had not either changed its position, or become contracted in its dimensions. The axis of the crescentic edge of the membrane, bounding it inferiorly, was directed upwards, and to the right.

Ligatures having been applied to the pulmonary arteries and veins, which, it may be observed, were distended with blood, the lungs were removed from the chest. They were large, and presented, externally, the variegated colour already described; but they had obviously not become inflated posteriorly. In the light-coloured portions, they were feebly crepitating beneath the fingers. They weighed 586 grains, which is about the weight of lungs that have not respired*.

By the test of Ploucquet, *i.e.* dividing the weight of the body by the weight of the lungs, the ratio obtained was as follows :

$$33465 : 586 = 57 : 1.$$

This falls within the ratio, derived from the lungs of children that have not breathed.

* The air, which had been artificially introduced into them, could not of course add to their original absolute weight, since they were weighed in air. This is one of the diagnostic marks of artificial inflation.

According to Orfila (*Méd. Lég.* l. 350.) the fetal lungs *always* weigh less after artificial inflation than before. In one or two cases only I have observed a very slight difference; which appeared to me to depend upon the air, when violently introduced, forcing out a small portion of the blood contained in the vessels.

We have now then collected, I think, sufficient data to answer the question proposed. The colour, volume, and consistency of the lungs, their absolute weight, and the ratio obtained by Ploucquet's test, render it in the highest degree probable, if not absolutely certain, that this child *had not lived to respire*. It will be here remarked, that one strongly corroborative sign of respiration connected with the lungs, namely, their *specific gravity*, was wanting. No inference could be derived from the employment of the hydrostatic test in this case, since the lungs had been artificially inflated; but it cannot be doubted, on attending to the whole of the circumstances, that, had not air been thus introduced into the organs, they would have sunk in water, either entire, or divided into pieces.

I shall next state the nature and results of the experiments performed on the lungs. When separated from the heart and thymus gland, and placed on temperate distilled water, they readily floated. Their specific gravity was found to be .943. The organs were not in the least putrefied: indeed, there was no sign of putrefaction in the body, the child not having been dead above twenty-four hours, and the temperature of the atmosphere being very low. To determine the nature of the changes which they were likely to undergo, the lungs were again placed in the chest, and the body was set aside for a week. At the end of this time, although there was no appearance of decomposition, the colour of the lungs had become much altered on the surface. The parts to which the atmospheric air had had slight access were of a pink red; the other parts were of a slate grey. The bright red patches, which had resulted from inflation, had entirely disappeared; and the inflated could no longer be distinguished from the uninflated portions. There was now not even the slightest feeling of crepitation, on pressure, in any part of the pulmonary structure. Placed on distilled water, they floated as well when united as when separated from each other. There was no perceptible difference in the degree of buoyancy of the two lungs.

Each lung was then separately compressed, *entire*, in a folded cloth, as well as between the fingers; but the most violent pressure, for some time continued, did not so expel

the air, as to cause either of them to sink when again placed on water.

The right lung was next divided into twelve pieces. In cutting it, there was no obvious crepitation; but the parts containing air were distinguished by their bright crimson redness, the surrounding parenchyma being of a deep Modena-red colour. On examining the divided portions, it was observed that they were perfectly free from disease. Each of the divided portions which floated was separately subjected to firm pressure in a folded cloth, as well as between the fingers; care being taken not to carry the compression to such a degree as to destroy the organic texture of the lung. After this, they readily sank, when placed on water.

The left lung was now inflated to the greatest possible extent, by the introduction of a blow-pipe into the bronchus. It became universally of a light *pink-red colour*, not distinguishable from that of lungs which had respired; and it was strongly crepitating under the finger*. On examining it externally, there was no air to be seen extravasated, or collected in vesicles beneath the surface—an appearance not unfrequent in artificially-inflated lungs. When placed on water, this lung was, of course, extremely buoyant. It was again compressed entire; but the air could not be expelled from it, so as to make any perceptible difference in its buoyancy. It was then divided into twelve nearly equal portions: there was a distinct crepitus perceived in the division: the cut surfaces had a mottled appearance, and, on compression, air was freely extricated. The divided portions were separately compressed in folded cloth, aided by the fingers; and each piece experimented on, successively lost its air, and sank. Several of them required a frequent and violent repetition of the pressure, before the air was sufficiently expelled from their substance to render them heavier than water. Care was taken so to regulate the degree of compression, as that the structure of the lung

* It is singular, that so acute an observer as Professor Meade should deny that the colour of inflated lungs resembled the lungs which have respired. The inflated organs he describes as having a greyish-white or a dusky-red colour (*schmutzgrüthlich*).—*Handbuch*, 390.

should not be destroyed. It is proper to mention, that not one of the divided portions presented, on examination, any appearance of disease.

These experiments, which, I may observe, I have for some years past frequently performed upon the lungs of still-born children with the like results, appear to me to establish, that air, introduced by artificial inflation, may, under all circumstances, be expelled by compression, if the experiment be properly performed, and the pressure continued a sufficient length of time*. The very violent compression, described as necessary for the expulsion of air from the divided portions of the left lung, in this case, is not likely to be often required in practice; since it is doubtful whether a lung could become so fully inflated as this was, while lying within the cavity of the chest. Besides, it must be remembered, in alleged infanticide, inflation can only be resorted to for the purpose of *resuscitating* a child. Violence in such a case is therefore out of the question; or if we found, by the appearance of the lungs, that very great violence had been used, there might be some ground for suspecting that the intentions of the party who performed the experiment

* The compression of inflated lungs, as a diagnostic sign, was, I believe, originally proposed, many years since, by the ingenious Béclard. The late Mr. Jennings (of Leamington) has the reputation of having first employed it, and shewn its value in this country. When individuals, pursuing the same course of experiments, arrive at similar conclusions, it is, I conceive, a matter of satisfaction to both; since their results serve to afford a mutual corroboration of each other's views. It was thus that the late Mr. Jennings and myself were situated. We were, it appears, without any knowledge of, or communication with, each other, endeavouring to remove some of the difficulties connected with the subject of infanticide: and we have formed very similar opinions relative to the effects of compression on artificially-inflated lungs. The real facts of the case are, if I mistake not, these. Mr. Jennings's Observations were published in the Volume of the Transactions of the Prov. Med. and Surg. Association for the year 1833. My Essays were in the hands of the Editors of the London Medical and Physical Journal in the autumn of 1832; and they were published in the Numbers of that Journal for November 1832, and January and May 1833. It is not improbable that both Mr. Jennings and myself may have been anticipated in our researches by others in this country: at any rate, it is certain that similar experiments were made by the German medical jurists upwards of sixteen years ago.—*Vide* Meade's Ausführliches, Handbuch der G. M. Dritter Theil, p. 493.

could not have been quite so innocent as they may be represented*.

It will perhaps be deemed not inappropriate, to mention, in this place, the possible effects of violent inflation on a living child. M. Leroy d'Etiolles shewed, so long back as 1826, that when air was forcibly propelled, by inflation, into the lungs of living animals, death was a very speedy consequence. The animals upon which he experimented, were, rabbits, middling-sized dogs, and sheep. Out of seven sheep, four died immediately, and three lived a quarter of an hour. On inspecting the bodies, the air-cells were not found lacerated, at least in those animals in which death was immediate; but there was evident extravasation of air in the chests of the others†. Experiments like these, performed on animals which are breathing, are not perhaps strictly analogous to those instituted on new-born children that have not respired; but the analogy may be permitted to hold, in so far as to allow of the inference, that violent inflation may effectually destroy the life of a new-born child, whether it have manifested life by breathing or not. It is scarcely possible to imagine, that a person who had sufficient knowledge to attempt inflation for the purpose of resuscitating a child, would not, at the same time, have sufficient judgment to avoid great violence in its performance. Hence it follows, that, for all the purposes of prac-

* We must, of course, make all due allowance for inexperience on the part of the person who performs the experiment. Unless the child's nostrils be closed, it is scarcely possible, without very long-continued efforts, fully to inflate the lungs. Loder, in an experiment of this kind carefully conducted, found, to his astonishment, on an inspection of the body, that the lungs were almost universally of a fetal colour, with only a few lighter patches scattered about them. When placed on water, they instantly sank. When divided and again tried, a few pieces, amounting only to about *one fourteenth part* of the lungs, floated! *Meisger, Op. cit.* 391. *Meade, Op. cit.* 389. The experiments of M. Billard have established, that the more immature the child, the more difficult is it to inflate its lungs throughout their whole mass. *Orfila, Op. cit.* I. 362. Martini mentions the violently blowing of air into the mouth of a new-born child as one of the methods of committing infanticide. *Introductions alla Medicina Legale*, III. 17.

† *Vide* Orfila *Médecine Légale*, I. 360. Also, *Arcana of Science*, 1828, p. 100.

tice, the experiment of compression may be expected to succeed in forcing the air out of lungs that have been artificially inflated.

When, besides the effect of compression on the lungs of this child, we take into consideration their other characters—as, for example, their absolute weight, and the relation of this to the weight of the body—we have strong grounds for asserting, supposing that the whole history of this case had been unknown, and the lungs had actually been found to contain air on opening the thorax, that the child had not lived to respire. The next question to be solved, is :

Was the child born alive?

I need hardly observe, that, although we have shewn that a child has not breathed, this is no proof of its not having been born alive. Children may be born, and live after birth, without respiring, certainly a sufficient time to be murdered; and the law of England, at least as it is interpreted by some of the high authorities who at present occupy the Judicial Bench, does not insist upon proof of respiration as a necessary mark of live birth—a principle, in the justice of which we must all agree; although it may be extremely difficult to produce evidence of life after birth, where respiration has not been performed; since most of the physical proofs of life, met with in the new-born child, are dependent on the establishment of this process.

Among the evidences of live birth are the changes in the divided portion of the umbilical cord, which have been so accurately described by Billard. These, which will be treated of hereafter, are considered, by M. Devergie and others, to be so well established in the order and time of their appearance, as to furnish proofs, not only of a child having been born alive, but of the actual period, within certain limits, which it has survived. It is to be observed, however, that where we do not find signs of respiration in the lungs, we are not certain of meeting with these changes in the umbilical cord; and where proofs of respiration exist, they are but of secondary importance. The case of this child offers a remarkable illustration of the fallacy of exclusively trusting to their presence, as evidence of the

period of survivorship after birth. The abdominal portion of the umbilical cord presented all the characters which I have frequently witnessed in children that had survived their birth some hours. The skin, covering it for about half an inch from its abdominal insertion, was smooth, and perfectly continuous with that of the abdomen. Beyond this, and as far as the ligature, *i.e.* for about an inch in length, it was corrugated, and of a yellow colour, but not dry or transparent. At the junction of the sound with the shrivelled portion of skin, there was a *faint line of redness*, like that of incipient inflammation, gradually diffusing itself towards the skin of the abdomen*. This child was born dead; but it so happened, that there was an opportunity of comparing the appearances of the cord with those of another child which had survived its birth twenty-four hours. The only observable difference was, that in the latter the cord was dry and transparent. The examination of both children had been made about twenty-four hours after death. The appearances of the cord, as will be stated presently, may sometimes shew that a child has lived after birth, although not the period which it has survived.

I have already anticipated the conclusion, to which we should have come, respecting this child—that there was no evidence of its having been born alive. The absence of all signs of respiration is, *cæteris paribus*, a good presumption against live birth; for few children come into the world alive without respiring, either during birth, or very soon afterwards. But there were certain appearances about this child's body, which proved that it must have been living at or about

* This is not a singular instance. M. Devergie met with a case, in which the umbilicus of a child, that had been born dead, presented a similar appearance. The skin around the navel was marked by an inflammatory redness. *Méd. Lég.* I. 507. It is the more important to notice the occurrence of this condition of the cord in a still-born child; since many have regarded the redness as the best means of distinguishing the separation of the cord, during life, from that which takes place after death. Not only, however, may the redness be absent in the vital separation; but it may be present in the child which has come into the world dead. Billard supposed that those cords which were small in diameter, alone separated, without an inflammatory redness ensuing. This observation requires to be confirmed by the researches of others.

the time of its birth. The left side of the head and neck, as well as the left shoulder, were deeply reddened. The redness was clear and diffused, not livid, or defined in patches. On cutting into the skin, at these parts the colour was found to depend on a slight infiltration of blood in the upper layers; but there was no decided effusion. The presence of this discoloration was a clear proof, either that the blood was circulating, or that it had but very recently ceased to circulate, at the time of its production. No pressure or force, applied to a child which had been dead some hours, would have sufficed to produce this appearance. I was informed that the child was alive during parturition; and that the labour had been difficult and tedious. The superficial discoloration about the head and shoulders would have led to this inference, supposing that the facts had not been known. There was no particular appearance in the body, to account for death; but it is highly probable that the child had died from exhaustion, during the protracted delivery. It is possible, also, that the circulation between it and the mother had been interrupted before the act of respiration could be performed.

This case bears out the general correctness of the data, upon which medical jurists are accustomed to act in investigations respecting infanticide. Some have laid down the doctrine, that the pulmonary vessels are collapsed, and destitute of blood, in a child which has not breathed. This doctrine can scarcely have been founded on actual observation; since, as in the case before us, although a child has not breathed, and has been born dead, they are often distended with blood. The quantity contained in the vessels may vary materially, before and after complete respiration; but this difference is only relative; and it is therefore inapplicable as evidence, either for one condition or the other*.

The lungs weighed 586 grains. This is stated to be about the average weight of lungs which have not breathed. Observers, of course, differ materially in their statements on

* See Orfila, *Méd. Lég.* I. 341, 363.

this point; but all make a considerable difference between the weight of respired and the weight of non-respired lungs. The mean weight of healthy lungs, calculated from their weight in six mature children which had died without breathing, I found to be 569 grains; while the weight of well-developed organs, which have fully respired, is rarely under 1000 grains. In one instance of a still-born child, the lungs weighed no more than 300 grains; but this child had evidently not reached maturity. On another occasion, a case of suspected child-murder, in which respiration was highly probable, although not certainly ascertained, the lungs weighed 1950 grains. I remarked, in this case, what I believe to be a general fact, that the right lung was much heavier than the left. The right lung weighed 1110 grains; —the left, 840 grains. The cause of this increase in the absolute weight of the lungs after respiration is well known to be due to the increased circulation of blood through the minute vessels of the organs. In order that it should be properly observed, it is necessary that the process should have become well established. Respiration, therefore, differs from all other causes which render the lungs buoyant in water in the fact, that this process increases their absolute weight, while it diminishes their specific gravity. Of all the physical changes in the lungs, as evidence of respiration, the least liable to fallacy is that connected with the increase of weight. The lungs may be of a light-red colour, fully prominent in the chest, highly crepitant to the feel, and very buoyant in water; yet if their absolute weight be not raised above that of the foetal condition, it is almost, if not absolutely certain, that respiration has not been performed. The other appearances may be due to various causes; but supposing the lungs to be healthy, no other cause can add to their weight but the change in the pulmonary circulation, dependent on the introduction of air into their substance by respiration.

Ploucquet's test gave a ratio of the lungs to the body, of 1:57. The founder of the test conceived that the average ratio for children which had not breathed, would be 1:70; and for those which had breathed, 2:70 or 1:35. Subsequent researches, however, have shewn that these numbers

must not be considered to represent the true averages*. The most serious objection to the employment of this test, in cases of infanticide, is, that the lungs and the body are liable to vary in their relative weights, in children of the same age; and, *à fortiori*, this variation must exist to a great extent among children which have reached different ages. It is easy to understand, that, during gestation, there may be various degrees of development in the body, without any necessity existing for a corresponding development taking place in the lungs. It is unnecessary to enter into speculations relative to the causes: experience has shewn that such variations really exist; and all that the medical jurist has to consider, is, whether the differences can be reduced within limits which may make the test available in practice. M. Devergie has found that Ploucquet's test affords no satisfactory results, as applied to children which have not reached the *eighth month* of gestation. At this age, according to him, the ratio is:

| | |
|----------------------------|---------------------------|
| <i>Before respiration.</i> | <i>After respiration.</i> |
| 1 : 63. | 1 : 37. |

And in the *ninth* month :

| | |
|----------------------------|---------------------------|
| <i>Before respiration.</i> | <i>After respiration.</i> |
| 1 : 60. | 1 : 45. |

The ratio, he observes, becomes higher after respiration, in proportion to the degree of perfection with which the process has been carried on†.

I have founded the following Table on a few cases which have come before me :

| <i>Weight of the Body.</i> | <i>Lungs.</i> | <i>Ratio.</i> |
|----------------------------|-----------------|---------------|
| 14400 gr. | 300 gr. | 1 : 48 |
| 33847 | 687 | 1 : 53 |
| 36000 | 630 | 1 : 57 |
| 33465 | 586 | 1 : 57 |
| 38400 | 640 | 1 : 60 |

* It appears that they were derived from observations on *two* children born dead, and *one* immature child which had breathed. Orfila, Op. cit. I. 342.

† Médecine Légale, I. 556. — These results appear somewhat paradoxical. They lead to the inference, that respiration is more perfectly set up, after a given time, in a child born at the eighth month, than in one born at the full period.

In all of these, the child had been born dead, and had *not* respired during birth. The first case ought, perhaps, to be withdrawn from the list, as the child was immature. This Table will give a mean average ratio of 1 : 55 for children whose lungs have not received air, or of 1 : 57 for *mature* children. The mean of three cases of children which had breathed, I found to be 1 : 35, corresponding to the ratio laid down by Ploucquet. In one still-born child, the ratio was 1 : 48 ; and in a child which had lived twenty-four hours, it was 1 : 41. From these remarks it will be seen, that Ploucquet's test, although very far from being infallible, is capable of serving as a good corroborative proof. In the case of the child which is the subject of these remarks, the ratio was 1 : 57 ; and this, coupled with the other circumstances, affords evidence that the child had not breathed.

The artificial inflation of the lungs was here purposely performed, in order to complicate the case : but supposing the lungs to have been so found on inspection, a medical jurist would have had just ground for suspecting that the air had not been derived from respiration. The weight of the lungs was not altered : it was the same as in the *fœtus* ; and the air, contained within them, was expelled by compression. In regard to the last-mentioned criterion, it may be asked : Is it not possible, by continued compression, to expel air from lungs that have actually respired ? The answer which several experiments enable me to return to this question, is : That when the lungs have been *fully distended* with air by respiration, it is impossible to force out that air by the mechanical compression of any of the divided portions of the organs. If the pieces of lung be reduced to a perfect pulp, such as by lengthened trituration in a mortar, then, undoubtedly, the air from respiration will be forced out, and they will sink. But this is a condition which ought to be positively avoided in the performance of the experiment. If the compression be in any instance carried so far, as that the organic texture of the lung is destroyed, no safe medico-legal inference can be drawn from the result of the experiment. So far as the few observations which I have been able to make allow me to

form an opinion, the air propelled into the lungs, even at the maximum degree of artificial inflation, can be expelled by compression in the manner described, without the destruction of their organic texture. The retention of air, sufficient to render portions of the organs buoyant, after very firm compression, is then, in my opinion, strong corroborative evidence of its having been derived from respiration; and thus it is advisable, whenever the hydrostatic test is employed, not to draw an inference from the floating of the lungs in water, until after the floating portions have been *firmly* compressed. The evidence thus obtained is to be regarded as only *corroborative*; because, in Medical Jurisprudence, it is proper to found an opinion, not upon one, but upon all the medical circumstances of a case.

It has been said, that compression will not extricate air from lungs which have *fully* respired. By this, it is not to be understood that the experiment of compression can only be practically applied, to distinguish respiration, in those cases in which a child has lived for a considerable time after its birth. I have found it to succeed, even where a child had lived to make no more than one or two respirations, and had died before it was actually born. In this case, it was found necessary to destroy the child while the head was presenting, in order to effect delivery. It lived, however, a sufficient time after the protrusion of its head, with the greater part of the brain evacuated, to cry loudly for an instant. The general appearance of the body shewed that it had attained to the full period of gestation. On opening the thorax, the lungs were seen projecting slightly forwards, over the sides of the pericardium. They were of a light-red colour, but not crepitant under the finger. They had the external physical characters which these organs are known to acquire on the first establishment of respiration; but the entire absence of crepitation proved that the process could have been but very feebly performed. The colour of the external surface was throughout uniform; a circumstance which I have never witnessed in lungs that had been artificially inflated, except where the inflation had been carried to its fullest extent. Then, however, there is, commonly, distinct crepitation. A uniformly light-red colour,

and an absence of crepitation, are, so far as my experience will allow me to speak, characters of respired, not of artificially inflated lungs.

When removed and placed on water, these organs floated freely; and on being separated, both appeared equally buoyant. Each lung was next divided into sixteen pieces, and every piece floated. In dividing them, it was observed that the colour was uniform throughout their substance: there was no sense of crepitus under the knife; nor could the air-cells, in which the air was diffused, be seen. The pieces were then subjected to very forcible compression, for a considerable time, in a folded cloth. The cloth was ruptured by the force employed; yet, on removing the pieces and placing them on water, they all continued to float. A portion of air had undoubtedly been forced out, but not sufficient to deprive any of them of their buoyancy.

By this we learn, that, in some instances, two or three respirations only will stamp upon the lungs, characters by which they may easily be distinguished from those organs that have undergone artificial inflation. The compression was carried to the furthest possible limit, consistently with the preservation of the organic structure of the lungs.

It must not be supposed, that, in all children which have lived but a second or two to respire, similar results will be obtained. The respiration of an instant may distend the lungs of one child, as much as respiration, continued for several hours, would those of another. The time which a child has survived its birth, does not allow us to predict, to what degree its lungs will be found distended on inspection, or what the results of experiments on those organs will be.

A child may have very feebly respired, and died either a few minutes or a few hours after its birth: and it is a question worthy of being examined, whether compression, sufficiently long continued, will force the air out of lungs that have become thus imperfectly distended. There is, of course, no definite boundary between the full and partial distention of these organs: but it is not strictly correct to apply inferences, derived from experiments on them in their fully distended state, to those instances in which they have really received but a small quantity of air. By this

imperfect distention, I shall understand that condition of the healthy lungs in which they contain only sufficient air to render them buoyant in water; and from the slight difference in their specific gravity and that of water, a very small quantity will suffice for this. In these cases, moreover, the colour, volume, and consistency, are scarcely changed from the foetal condition. Certain experiments, some of which will be related hereafter, have led me to the conclusion, that if lungs, thus feebly distended, be divided and compressed, they will be deprived of sufficient air to render them heavier than water; and this effect will follow without a necessary destruction of their organic texture. In most works on Medical Jurisprudence, it is laid down as a positive axiom, that air, once introduced by respiration, can never be forced out of the lungs, so long as their substance is not destroyed. It does not seem to have been imagined that the results of experiments may differ, according to the degree to which the process has been carried on. The difference, I believe to depend on this: in feeble respiration, the air passes into the larger divisions of the bronchi only, not into the minute bronchiæ or air-cells. Ploucquet, Roose, Schmidtmüller, and Schmidt, long since made this remark*.

The admission, that air may be compressed out of feebly respired lungs by the same means as out of those which have been submitted to artificial inflation, may appear to render compression useless, as a diagnostic sign of artificial inflation; but we must not forget, that other corroborative sources of evidence may be forthcoming. The experiment of compression will distinguish all cases of complete respiration from those of artificial inflation; and, if for this circumstance alone, it ought to be regarded as an adjunct, occasionally of great value in these investigations†.

* "In solchen Fällen dringt die Luft zwar in die Luftröhre, und in die grösseren Aeste derselben, nicht aber in die kleinern Aeste und Luftzellen." Henke, Von der Lungen-und-Athemprobe. Lehrbuch der G. M. p. 375. Also Niemann. Taschenbuch der gerichtlichen Arzneiwissenschaft, p. 91. Orfila, Médecine Légale, I. 337, 372. Meckel. Lehrbuch der G. M. 370.

† Orfila, who, in general, may be considered as one of the most accurate of French medical jurists, expresses himself very obscurely relatively to the effect of compression on the lungs. In one part of his excellent work (Méd.

It must, I think, be admitted, that there are no means of distinguishing feeble respiration from artificial inflation which has been carried only to a slight extent*. The physical characters of the lungs will be unaltered; and compression will, in either condition, destroy their buoyancy. In a case of this kind, I apprehend the only course left open to a medical witness is, to state to the jury, that the evidence, derived from experiments on the lungs, left it uncertain whether the child in question had respired or not. The jury will then know how to return their verdict; for it must be remembered, they have always circumstances to guide their judgment, as well as medical opinions; and it is upon the whole, and not upon a part of the evidence laid before them, that their verdict is founded.

It is singular that this occasional difficulty of distinguishing artificial inflation from respiration should have been represented as a serious objection to the employment of the hydrostatic test. Even admitting, in the very few instances in which such a defence on the part of a prisoner is possible, that the practitioner is unable to distinguish the one condition from the other, this becomes purely a point for the consideration of a jury: it cannot affect the general application of the test†. Examples of this sort of difficulty are by no means uncommon, in the practice of Medical Jurisprudence. Thus, to take what appears to me a parallel case:—A man,

(*Méd. Lég.* I. 368.), he says: "The air derived from respiration is contained within the bronchial cells; and can only be expelled from them (by compression) with the greatest difficulty." While, at another part (p. 363), we find him asserting, "That under artificial inflation, or respiration, the air is contained in the bronchial cells; and in *neither case* can it be entirely expelled by compression. Those who have contended that inflated lungs may be made to sink by pressure, can only have experimented on lungs in which the inflation had been carried to a *small extent*." He does not seem to have anticipated the answer, which might be made to his own statement; namely, that where the inflated lungs had not been made to sink, the compression had not been carried far enough.

* M. Devergie adopts this view, from his experiments; but he denies that the buoyancy of the lungs can be destroyed by compression. *Méd. Lég.* I. 571. See also Meckel. *Lehrbuch der G. M.* 368.

† A case is recorded by Bohn, in which the mother artificially inflated the lungs. Meckel. *Lehrbuch der G. M.* 368. This, so far as I know, is the only instance on record.

while labouring under symptoms of cerebral disease, receives a blow on the head: he dies in five or six weeks afterwards; and a considerable abscess is found in the brain. A witness is asked to state, whether the abscess resulted from the blow, or from previous disease. He is in doubt; and he expresses that doubt to the Court. But, because he is unable to give a positive opinion in this instance, he would not be justified in abandoning the ordinary rules of surgical diagnosis in any future instance of a similar kind that came before him.—Again, the stomach, in a case of suspected poisoning, is found inflamed, or perforated; and a medical witness may be unable to swear, whether the appearances were due to poisoning or disease, in that particular instance. But this will not prevent him from relying, in general, upon morbid appearances, as a good source of evidence in all future questions of poisoning. Many other instances might be adduced of medical evidence becoming doubtful, from circumstances, wholly independent of the will of the practitioner, and over which he has no possible controul. In the determination of any single point in a case of child-murder, a doubt may arise: the question relative to the respiration of the child is not exempted from this rule: but it would be the height of inconsistency, to contend, that, because certain means of investigation will not always enable us to express a positive opinion, we should never have recourse to them.

I presume that, in the present day, no practitioner would trust to the floating of the lungs as a sign of respiration, before he had ascertained that the air contained in them could not be expelled by compression. The charge against an accused party is not likely, therefore, to be sustained by medical evidence of the respiration of the child, unless the child have actually respired; but it is possible, that, owing to a want of evidence to characterize feeble respiration, a really guilty woman may escape. The mischief to be apprehended is not then, as it has been often alleged, that the employment of the pulmonary tests may lead to the *condemnation* of an innocent, but rather to the *acquittal* of a guilty person. This is certainly an unfortunate circum-

stance; but it is one for which medical science is not yet in a condition to provide an adequate remedy.

The conclusions derivable from this case and the observations accompanying it, appear to me to be the following:—

1. That the medical examination rendered it in the highest degree probable that this child had not breathed.
2. That there was no proof of its having been born alive.
3. That a line of *inflammatory redness* may be met with on the umbilical cord of a child born dead.
4. That the pulmonary vessels may be found *distended with blood* in a child born dead.
5. That artificial inflation is only likely to be met with, to a *partial extent*, in the lungs of new-born children.
6. That compression will expel the air from lungs inflated artificially to a small or great extent.

CASE 2.

Age or degree of maturity of the child.

THIS child was a twin of the male sex. Its body was small, and not well developed. Its length was $18\frac{1}{2}$ inches; and the point of attachment of the umbilical cord was $9\frac{1}{2}$ inches from the vertex, therefore a little below the centre of its length. The hair on the scalp was abundant and long: the nails of the fingers and toes were well formed, and reached to the extremities of the phalanges. The skin was pale, except about the neck, head, and face, where it was of a diffused bright-red colour. The membranæ pupillares had disappeared. The testes occupied the scrotum. The chest was narrow at the upper part, wide below, and flattened in front. The body weighed 24590 grains, i. e. about $4\frac{1}{2}$ lb.

From these data, we are perhaps entitled to infer that this child had not quite reached maturity. Its weight was much below that commonly laid down for mature male children; but this is sufficiently accounted for, by its being a twin child, and by the general want of development in its body.

Had the child lived to respire?

On laying open the chest, the thymus gland appeared unusually large, and of a pale livid colour, with a slight pinkish hue. The lungs occupied the posterior parts of the cavity, projecting forwards by their anterior margins, and covering slightly the posterior and lateral parts of the pericardium. Their colour was somewhat mottled; but the greater portion of their surface presented the usual livid hue of the foetal organs. The right lung at the apex of the upper lobe and side of the middle lobe contained air in vesicles visible to the eye. This air was irregularly diffused over the surface, presenting, here and there, well-defined patches of a light-red colour. The upper part of the right lung was crepitant beneath the finger; but the lower lobe was firm and solid, giving not the least sign of crepitation. The left lung seemed to contain less air than the right; but at the posterior part of the inferior lobe, in the midst of a light-coloured patch, was a *prominent vesicle* of air about the size of a grain of corn. The lungs, as well as the body, were free from all traces of putrefaction; the child not having been dead above twenty-four hours, in the month of January.

The ductus arteriosus was large, and of equal diameter throughout. The foramen ovale was, as it is usually found, in the foetus; the fossa ovalis being three-fourths closed by the valvular membrane. The blood, which escaped from the large vessels and cavities of the heart, was liquid and dark-coloured. Ligatures were applied to the pulmonary vessels, and the lungs were removed. Both the pulmonary arteries and veins contained blood.

The absolute weight of the lungs was found to be 562 gr., about the average of those that have not received air from respiration. The test of Ploucquet, gave the following ratio :

$$24590 : 562 = 44 : 1.$$

It will be seen by this, that the result of Ploucquet's test does not lead to an inference corresponding to that derivable from the absolute weight of the lungs. The difference does not appear to me to be difficult of explanation: the body weighed much below the average of that of a mature child, for the reasons already stated; and the lungs had not par-

ticipated in this want of development. The case proves what has been already remarked,—that there is no necessary relation between the weight of the lungs and the body, in all children and at all periods of gestation. Had this child been of the average weight, Ploucquet's test would have given a satisfactory result; but as it was, while the weight of the lungs tended to shew that the child had not breathed, the relation of their weight to the body left it doubtful.

When placed on temperate distilled water, the lungs floated, but the right appeared more buoyant than the left. The two lungs continued to float, when separated from each other. They were now divided into a number of pieces: during the division, there was evident crepitation. On placing the pieces of lung on water, the greater number floated, while some sank to the bottom. On examining those which sank, they were not found congested or diseased; their sinking being evidently due to their not having received air. Those which floated, presented, on examination of their cut surfaces, spots of a vermilion redness in the midst of the livid or fœtal colour. The specific gravity of the organs, before division, had been ascertained to be .946. The portions which floated, were now subjected to violent compression in a folded cloth; and after this, all of them sank readily to the bottom of the vessel. Some of the pieces, however, required several successive trials, before they were rendered heavier than water.

Such, then, were the data upon which an opinion was to be raised, as to whether this child had breathed or not. In favour of respiration, we have: 1. The light-red colour of the lungs partially diffused; 2. The slight prominence; 3. The partial crepitation; 4. The buoyancy in water of the larger portion of the organs. Against respiration: 1. The air-vesicles being visible to the eye*; 2. The absolute weight of the organs, which was not greater than the average

* The invisibility of the vesicles or cells containing air is mentioned, by most writers, as a proof of its having been derived from respiration. When the vesicles are large and visible, the air at the same time not being due to decomposition, the presumption is, that the lungs have been violently inflated, and that air has become thereby extravasated. This diagnostic sign

weight of foetal lungs; 3. The total expulsion of the air contained in them by compression.—All the facts of the case are explicable, on the supposition of artificial inflation, or of feeble respiration. The child, if it had breathed at all, could have breathed but very imperfectly.

The history of this case, as it was given to me by the gentleman who attended the mother, was, that the child survived its birth about *half an hour*; and appeared, during that time, to respire. It was born in a lifeless state, and artificial inflation was immediately resorted to; but all signs of life ceased in about the time mentioned.

This statement sufficiently accounted for the mixed characters of respiration and artificial inflation, which the lungs presented. But had the child not respired after birth, the characters of the lungs would, doubtless, have been similar to, if not identical with, those found: for it is certain, that the process had not been performed for that length of time, and in that degree which are necessary to produce any well-marked changes from their foetal condition. It is also certain, that the appearances which they presented were such as are imparted to lungs by artificial inflation. This, then, is a case which shews that a medical jurist has it not in his power to determine positively that a child has respired, if the process have been only feebly performed. The air is, under these circumstances, as readily forced out by compression, as if it had been artificially introduced.

There was nothing about this child to shew that it had been *born alive*—a question which is of course entirely distinct from that of its having respired; although the two are sometimes strangely confounded together, as if there were always a necessary connexion between them. When the lungs are fully distended with air, and all the other charac-

sign is not, however, free from exceptions. I have met with a case to be presently described, wherein the air, although undoubtedly derived from respiration, was scattered over the whole surface of the lungs in large visible vesicles.

Mende, the learned Professor of Greifswald, mentions this extravasation of air in the lungs, among the characters of artificial inflation. He found it in the substance of the lungs, as well as on the surface. The larger vesicles existed, according to him, at the anterior and superior parts of the organs. *Ausführl. Handb. 3ter Th. p. 391.*

ters of respiration are strongly developed in them, I am willing to allow that we have a condition highly presumptive of a child having come *entirely into the world alive*. But in all cases of feeble respiration—and these, probably, form the majority in charges of child-murder, since the child is destroyed either during birth or immediately afterwards—we have no right whatever to draw the inference that the child has been born alive, because circumstances may shew that it has breathed. This feeble respiration may be always set up before birth, and the child not live to breathe after it has been entirely born. We must then, in general, look for other marks about the body, besides those of respiration, in order to say whether or not it has come into the world alive.

In this case there was no evidence of live birth. The umbilical cord presented no appearance of inflammatory redness at the point near the abdomen: it was flattened, and yellow, beyond;—in short, it possessed no other characters than those which we might expect to find in the cord of a still-born child, after exposure to the atmosphere for the same length of time.

Had this case been wholly unknown, and the subject of a legal charge, a medical practitioner would perhaps have expressed an opinion that the child had not been born alive: but the facts prove, that such an opinion would have been incorrect, for the child survived its birth half an hour. Hence it follows, that, in some instances, a guilty woman may become improperly favoured, if we affirm, from the sinking of the lungs after compression, or from the absence of any changes in the ductus arteriosus and foramen ovale internally, or in the cut portion of the umbilical cord externally, that her child has been born dead. Unfortunately, there is, at present, no remedy for this deficiency in medical evidence. But, while waiting for satisfactory means of diagnosis, I do not see that we are entitled to express so strong an exculpatory opinion, relative to the mother, as we find generally expressed on these occasions. Facts, such as those encountered in this case, no more warrant a witness in saying that the child was born dead, than that it was born living; but a positive opinion relative to a child's being

born dead, would, in general, be given from the sinking of the lungs after compression; although there might be, for aught the witness knows, strong circumstantial evidence to prove that the child had really lived after birth, and had been criminally destroyed by its mother. The consideration of the possible occurrence of a case of this kind—of a child, such as we have here examined, becoming the object of a criminal charge—ought to make every practitioner hesitate, before he pronounces, from *negative* data, an opinion which evidence, subsequently adduced by accomplices or others, may prove to be false and unfounded. The opinion which, it appears to me, he should express, when thus situated, is, not that the child was born dead, but that there were no medical facts to shew that it was actually born living; although, still, it might have come into the world alive. Children that are the objects of these investigations are often found with their throats cut, with the bones of the head beaten in, or with ligatures firmly tied round the neck; and it is, of course, for a jury to consider, why such severe and mortal injuries should be found on the person of a child, whether its lungs sink in water, after compression, or not. But if, in opposition to medical experience, the witness positively affirm, from data of this kind, that the child was dead at its birth, the jury, relying upon the correctness of this dictum, can proceed no further in the investigation.

The state of this child's lungs was such as we might expect to meet with, in those children that have performed the act of respiration during birth. As this is a subject which generally gives rise to some discussion in cases of child-murder, I shall here make a few remarks on it:—1st, Respiration may be performed while the child is in the uterus, after the rupture of the membranes; the mouth of the child being at the os uteri. This is what is termed *vagitus uterinus*: its occurrence, although extremely rare, seems, to me, to rest upon undisputed authority*. 2dly, A child may

* For Cases and Remarks, see Henke. Lehrbuch der G. M. p. 371. Zeitschrift für die Staatsarzneikunde, 1821. Heft iii. S. 21. Also, Cyc. Pract. Med., Art. Pregnancy. Orfila, Méd. Lég. I. 367. Niemann. Taschenbuch, 89. Meckel. Lehrbuch der G. M. 366.

breathe while its head is in the vagina, either during a presentation of the head or of the breech. This has been termed *vagitus vaginalis*. It is not very common, but it must be set down as a possible occurrence. 3dly, A child may breathe while its head is protruding from the outlet: in this position, respiration may be as completely set up in a few moments, by its crying, as we find it in some children that have actually been born, and have survived their birth for several hours. This is the most usual form of respiration before birth. In the *vagitus uterinus* or *vaginalis*, the lungs receive but a very small quantity of air: in respiration, after protrusion of the head, the lungs may be sometimes found moderately well filled; although never, perhaps, possessing the characteristic properties of those which have fully respired. The well-known occurrence of respiration, under either of these three conditions, strikingly displays the fallacy of making that process, as some have done, the certain criterion of *extra-uterine life*. A child may breathe in the uterus or vagina, or with its head at the outlet, and die before its body is born: the discovery of its having respired would not, therefore, be any sort of proof of its having enjoyed what has been termed "extra-uterine life." The death of a child which has respired in the uterus or vagina from natural causes, before its entire birth, is a possible occurrence; but its death from natural causes before birth, after it has breathed by the protrusion of its head from the outlet, is, I believe, a very improbable event. All that we can say is—it may take place; but its death, under these circumstances, would be the exception to a very general rule*.

The hydrostatic test is only capable of determining that respiration has taken place: it cannot shew whether that

* Oberkamp, in four successive deliveries of the same female, observed that the children breathed before delivery, but died before they were born. A case of this kind also occurred to Diemerbroek. See Meckel. *Lehrbuch der G. M.* p. 367.

"Fieri potest ut infans, capite excluso, antequam totus excludatur respiraverit, statim vero moriatur." *Teichmeyer Instit. Med. Leg.* c. 24. 241. — Haller remarked, that such a case was not likely to occur, even once in a thousand instances: but this, in a matter calling for legal inquiry, is no answer to the objection.

process was established during birth, or afterwards. The fact of a child having the power of breathing before it is entirely born, does not therefore constitute the smallest objection to its employment; although, upon this ground, we find the use of it, in any case, denounced by many eminent men of the medical, and, I may say, by the whole of the members of the legal profession. The celebrated Dr. William Hunter remarks on this subject: "A child will commonly breathe as soon as its mouth is born or protruded from the mother; and, in that case, may lose its life before its body be born, especially when there happens to be a considerable interval between what we may call the birth of the child's head and the protrusion of its body. And if this may happen where the best assistance is at hand, it is still more likely to happen when there is none—that is, where the woman is delivered by herself*." Dr. Hunter here exposes, in plain language, the fallacy of trusting to signs of respiration alone, as evidence of a child having been born alive. The truth of his remarks is, in the present day, generally admitted: and if, among medico-legal writers, we find some still treating of respiration as a proof of live birth, it is from their not having sufficiently considered the probability of a child breathing and dying before its body is entirely extruded. But we may ask, How does the admission of these views affect a case of deliberate child-murder? A *living* child may be wilfully destroyed *before* its body is entirely born, as well as afterwards: and if the law of England do not contemplate the wilful destruction of a *living* child, before its entire birth, as a crime, this omission cannot be imputed as a fault to the medical jurist; nor can it at all diminish the real value of the hydrostatic test, as furnishing indisputable evidence of life. Most moralists, and perhaps legislators, might consider the crime of murder sufficiently made out, when the medical evidence shewed that the child had lived, and that it was *living* when *criminally destroyed*. If, however, this do not constitute infanticide in law; and evidence be further insisted on, to

* On the Uncertainty of the Signs of Murder, in the case of Bastard Children, p. 33.

set forth *where* the child was actually living when murdered—whether half protruding from the vagina, or altogether external to the body of the mother; then is the fact of a child respiring before birth, an objection rather against the principles of the law, than against the tests used to determine the presence of life. A case was tried but a very short time since, in which a child had been found with a ligature firmly tied around its neck. The medical evidence shewed, I think clearly, that it had breathed; and the whole of the appearances in its body were such as to leave no medical doubt that it had died by strangulation. The judge, in charging the jury, said, if they were of opinion that the prisoner *had strangled her child before it was wholly born*, she must be acquitted of the murder! The prisoner was acquitted*. However we may regard the question of the utility of the pulmonary tests, we cannot but look upon that law—to speak in the mildest terms—as but very imperfectly adapted to its purposes, which makes the proof of *murder* to rest, not upon the actual and wilful destruction of a *living* child, but upon the precise moment which a murderer may select for the accomplishment of the crime. Impunity is thus held out to all offenders, who destroy living children in the act of birth: but there is an additional evil, accompanying the operation of this legal rule, which seriously affects medical evidence, given on these occasions. The law will presume, until the contrary appear from other circumstances, that the respiration of a child, if proved by the best of evidence, was carried on before it was entirely born. Let the witness, then, in a case of

* This case proves—if any proof of the fact were wanting—with how little severity the verdicts of juries press upon individuals charged with this crime in England. From a case related by Poilroux, it would appear to be much the same in France. A trial for child-murder took place before a Court of Assize in that country, in which it appeared that the child was healthy, and had undoubtedly breathed. Its mouth and fauces were found stopped up with a plug formed of oak-leaves and dung, from which cause there was every reason to suppose it had died. The mother was found guilty of having caused its death by *negligence*! — “After such a verdict as this,” observes the reporter, “we might be almost justified in burning all that has been written on the subject of Infanticide.” *Poilroux, Traité de Médecine Légale Criminelle*, p. 165.

alleged infanticide, ever so clearly establish the fact of respiration, and therefore of life, at the time the violence was used, this evidence is not sufficient. He is asked whether he will depose that the child had breathed after its body was entirely in the world. Unless he can make this deposition—which, for obvious reasons, he cannot often be in a condition to do—the law will presume, that, although the child had breathed, it came into the world dead. In this way, we perceive, a shield is effectually thrown around those who are really guilty of having destroyed their children immediately after birth: but, under any moral consideration of the circumstances, I think it impossible to admit, that a woman who kills her child in the act of birth is less guilty of murder than she who chooses the moment of its entire expulsion to destroy it.

A German medical jurist, Dr. Brefeld*, has lately proposed to vary the gradations of crime in child-murder, according to the degree to which respiration has taken place. He divides the beings, which are the objects of the charge, into—1. The unborn *fœtus* (*Frucht*), which has not breathed. 2. That which is born, and has breathed, but so imperfectly as to render the fact incapable of demonstration: this is what he terms a *fœtal child* (*Frucht-kind*). And 3. That which is born and has fully respired—a *child* (*Kind*). How long soever a child may have lived after birth, he proposes to punish its wilful destruction according to the degree to which its lungs may have become distended with air. It does not seem to me that legislators would be justified in following such an hypothetical division as this. Whether a child have breathed perfectly or imperfectly, its wilful destruction ought to be regarded as murder. The proposer of this plan assigns no reason *why* it should be regarded as a smaller offence to destroy a child whose lungs are, owing to accidental causes, only half-filled with air, than one in which the organs have become fully distended.

The conclusions which we may derive from this case are:

* Beitrag zur Lehre vom Kindermorde, besonders in Beziehung, auf die Revision der Königl. Preuss. Strafgesetze. Henke. Zeitschrift für die S. A. 4. 1836.

1. The characters, presented by the lungs of this child, might have depended upon artificial inflation, upon feeble respiration, or upon both states combined.

2. That there are no satisfactory means of distinguishing artificial inflation from feeble respiration.

3. That there was no satisfactory evidence that this child had breathed; and therefore it follows, that a child may live and breathe for *half an hour* after birth, without its being discovered by a medical examination.

4. That life, prolonged for half an hour, may make no difference in the state of the ductus arteriosus or foramen ovale.

5. That there was no evidence to shew whether this child had been born living or dead.

CASE 3.

THIS was a male child, which was examined about thirty-six hours after death.

Age, or degree of maturity.

Externally, the whole of the body appeared plump and well developed. Its length was about $19\frac{1}{2}$ inches. The umbilical cord was inserted a little below the centre. The hair was full, of a brown colour, and at least an inch in length. The nails of the fingers and toes were completely formed, and reached to the extremities of those parts. The skin was smooth, and of a pale white colour; but over the face, chest, and sides, there were large well-defined patches of cadaverous ecchymosis, bearing the closest resemblance to those discolorations which are met with in the bodies of persons hanged or suffocated. The palms of the hands and soles of the feet were deeply livid. On the abdomen, the skin was slightly green, from incipient putrefaction; but the epidermis was in every part firmly attached to the cutis. The umbilical cord was tied, and dressed*. Between

* This, although it can be scarcely ranked among medical circumstances, is strongly corroborative of a child having been born alive. Why, indeed, it may be asked, should the umbilical cord ever be found tied and dressed in a child, which was actually *still born*? This may be set down as part of the presumptive evidence in a case; but a medical witness must endeavour to conduct his inquiries as if he had no presumptive evidence to guide him.

the ligature, and the future point of separation at the abdomen, the cord was flattened, horny, and transparent. The umbilical vein, contracted to a dark thread, was seen traversing the transparent part. The membranæ pupillares had disappeared. The testicles were in the scrotum. The body weighed 35930 grains, about six pounds.

From these facts, it was inferred that the child was either at, or very near, the full period of gestation.

Had it lived to respire?

The thorax was remarkably full, arched, and expanded. On opening this cavity, the lungs were seen of a dark livid colour, slightly mottled in places; but in no situation were they of a light-red hue, nor did they present any where the peculiar colour imparted to these organs by the process of respiration. They projected but very little forwards, covering, and partly concealing, the posterior and lateral parts of the pericardium. On pressure between the fingers, there was a dull and indistinct crepitation; which became more marked, when a portion of the blood, with which they were evidently congested, had been forced out. On examining the lungs more closely, it was seen that, scattered over the surfaces of both, especially anteriorly and externally, there were numerous vesicles of air, varying in size, but most of them not larger than a millet-seed. The air within them was apparently only retained by the pleural covering. The vesicles burst, and the air escaped, on very slight pressure.

The heart was large, and the pericardium contained an unusual quantity of serum. The right side of the organ was much distended with venous blood. The pulmonary vessels contained a quantity of dark grumous blood. The ductus arteriosus was also full, and of the same diameter throughout. The foramen ovale was placed nearly in the vertical line of the fossa: it was freely open: there was not the smallest appearance of contraction in the aperture. In fact, this and the ductus arteriosus were in their usual foetal condition. The thymus gland was large, and of a deep livid colour.

The lungs, when removed, weighed 774 grains; and by Ploucquet's test the following ratio was obtained:

$$35930 : 774 = 46.5 : 1.$$

They were next placed on distilled water ; and they slowly sank to the bottom of the vessel, where they continued, after moderate compression ; although by this, a quantity of blood was forced out, and the water became deeply coloured. It was observed that a number of minute air-bubbles escaped from the trachea, and rose to the surface on the moment of their immersion. Two or three incisions were made into them, from which blood flowed freely ; and they were allowed to remain in water, in a cool apartment, for twenty hours. At the end of this time, it was found that they had risen to the surface, and were floating, although slightly below the level of the water. In the mean time, it was evident that a quantity of blood had issued from them, for the water was highly coloured. They were now pale, but more crepitant than at first.

The lungs were then separated ; and it was observed that each floated. They were divided into a number of pieces. There was crepitation on cutting them ; and air obviously escaped from the cut surfaces, by compression under water ; but little blood now followed the incisions into their substance. Some of the divided portions, when placed in water, floated ; others sank ; while others, again, seemed to be in equilibrium. Those pieces which floated, when slightly compressed between the fingers without the use of a folded cloth, rapidly sank. In this way, every portion of the organs was ultimately rendered heavier than water. On examining the pieces which sank in the first instance, there was no appearance whatever of disease. The structure of the lungs was, throughout, perfectly healthy, so that their sinking could have been alone due to their not having received air. On dividing them, they were found of a uniformly venous red colour. Before making any remarks upon the data, which we have thus obtained, to solve the question of respiration, I think it right, as there is much that is peculiar in this case, to state, that the child had been born alive—that it had *lived six hours* after birth, the greater part of which time it was in strong convulsions. It seemed to suffer from oppression at the chest ; and made the most violent efforts to respire. Since it appeared active and strong, no attempt was made to inflate the lungs artificially.

Let us first inquire, whether it could have been inferred, from the experiments on the lungs, that this child had respired? When first examined, they sank in water, notwithstanding that they were *crepitant*, and *obviously contained air*. Perhaps, if they had been at this time divided into pieces, some would have been found to float, and others to sink; although the organs were much congested with blood—a condition that might have counteracted the effect of the air. But the subsequent experiments satisfactorily shew, that, even had any portions then floated, they would have been easily made to sink by compression; since this, applied only in a slight degree afterwards, caused every piece to fall to the bottom of the vessel. A circumstance worthy of remark is, that the lungs, although exposed in water during the night in a cool apartment, should have risen to the surface, and floated twenty hours afterwards. One of two causes must have operated to produce this change: 1. Gaseous putrefaction. 2. The slow removal of the blood, congested in them, by the water: in which case, they would easily acquire buoyancy, from the air that they contained.

It appears to me, that gaseous putrefaction cannot be admitted as having been the cause, for the following reasons. The lungs were perfectly fresh and sound, when placed at the bottom of the water, within the short period of twenty hours before. Although the weather was warm, the vessel was kept in a cool apartment; and access of air was cut off from the organs, by the water in which they were lying. Lastly, when removed, and cut to pieces, there was not, on any portion of them, the slightest smell or discoloration analogous to putrefaction. In truth, if gaseous putrefaction were admitted to have been the cause of this after-buoyancy, I do not see how we are to distinguish those organs which are putrefied, from those which are not. That the second cause was the more probable, may, I think, be hence inferred. The lungs were, at first, but little heavier than water: they sank very slowly, so that their specific gravity obviously differed, in a very slight degree, from that of water. From the great discoloration of the water, although the organs had been well washed previously to immersion, it was evident that a quantity of blood had been abstracted from them; certainly,

it might be imagined, sufficient to make all the difference observed in their specific gravity. From this view it follows, that sanguineous congestion was most probably the cause of their sinking in the first instance; and although compression was employed to force out the blood, it was not carried sufficiently far to render the organs buoyant. It is to be remembered, that extreme compression, in lungs which have feebly respired, will have the disadvantage of forcing out all the air, as well as the blood contained in them; so that this means of distinguishing the sinking arising from congestion may, unless employed with caution, occasionally defeat the object of the investigation. The better plan, probably, is to make a few incisions into their substance, and allow them to remain in water for two or three hours, without resorting to compression. In this case, no more pressure was employed at first, than was sufficient to expel the blood from the larger pulmonary trunks.

In answer to the question proposed, it will be observed, that we have no satisfactory proofs of this child having breathed. The physical characters of the lungs were not those indicative of respiration: neither the colour, nor the volume of the organs, afforded any evidence of the fact. Their absolute weight was but little above the average of those of the foetus. The test of Ploucquet left the question entirely doubtful. The ductus arteriosus and foramen ovale had not experienced the least alteration. The only circumstance in favour of respiration was, the feeling of a dull crepitation in the lungs, on pressure; but the air was diffused, in *visible vesicles*, over the surface of both organs; a condition which, if I may judge from my own limited experience, is rather an unusual mode of distribution for air received by respiration. Had I not known the facts of the case, I should have considered this appearance strongly indicative of the lungs having been artificially inflated; more especially, since all the other physical characters of respiration were wanting. But these lungs had certainly not been artificially inflated; and, therefore, the manner in which air is found distributed in these organs is not to be always regarded as a sure indication of its origin.

One striking fact was, their sinking when first experi-

mented on, although this child had lived and breathed for six hours after its birth. A reason for this has already been assigned; but still, it is a point worthy of fixing the serious attention of medical jurists. It shews most clearly that buoyancy of the lungs is not a necessary consequence of a child having lived and breathed for some time after birth. Probably, had this been a case calling for medico-legal inquiry, the lungs would have been cut to pieces and experimented on at once: this, at least, is the usual course. The sinking of the divided pieces, either before or after compression, would have been set down as negating the act of respiration, and, unless other strong evidence were forthcoming, the fact of the child having survived its birth. Here, again, we perceive the necessity of not assuming that a child has been born dead, because its lungs sink in water. There may be no good medical evidence of such a child having lived after birth; but assuredly the mere sinking does not warrant the common dictum, that the child was necessarily dead, when born*: it would be as reasonable to pronounce, in a question of poisoning, that the fact of an individual having died from poison was negated by the non-discovery of a poisonous substance in the stomach of the deceased. How would such an assertion, as this, be justifiable, on the part of a medical jurist? Yet a line of conduct, which would be denounced in the one instance, is almost constantly acted upon, in the other†.

Medical evidence, in a case like this, would have wholly failed to establish the fact of respiration; for the only circumstance in favour of the performance of the process, namely, the presence of air in the lungs, was rather weakened by the manner in which that air was distributed. In short, the appearances were those of artificial inflation; and would probably have been pronounced to have resulted from this cause, by most examiners; but still there was nothing to refute the possibility of respiration having been feebly per-

* There are several cases on record, in which, although the lungs sank in water, the mothers confessed that they had destroyed the children after birth. Meckel. Lehrbuch der G.M. 365. For Cases, *vide* Briand Méd. Lég. 251. Annales d'Hygiène, 1837. I. 407.

† See Orfila, I. 417.

formed. The state of the ductus arteriosus and foramen ovale, upon the contraction of which, as evidence of life after birth, so much stress has been laid by some writers, was the same as in the fœtus. The change in the diameter of the duct has been described as an immediate consequence of respiration; and it has been even laid down, that where we find its diameter unaltered, on an inspection of the body, we may pronounce that the child has not respired. The case preceding this, shews the fallacy of trusting to such exclusive views; but the present affords, perhaps, a still more striking instance of the error into which a medical jurist may fall, by adopting such hasty generalizations.

Considering the question of respiration altogether distinct from that of a child having been born alive, it will be necessary to determine, whether, in this case, we had any good evidence of live birth. It has been already remarked, that the signs of full and perfect respiration in the lungs are presumptive of live birth; but these signs were, here, altogether wanting; therefore the condition of the lungs afforded no evidence of the fact. The child might, or might not, have survived its birth for a certain period. In the same way, the ductus arteriosus and foramen ovale were not perceptibly altered, so that no evidence could be derived from the state of these parts. Marks of violence on the body very often lead to a presumption, which a witness should not neglect. Thus, supposing wounds evidently vital, and probably simultaneously inflicted, be found on different and remote parts of a child's body, this is presumptive of the whole of its body having been alive in the world, at the time they were received*. In the case under examination, there were no wounds or bodily injuries; there was merely diffused lividity, such as is usually witnessed in death by suffocation; but this was not of itself sufficient to allow of a safe opinion being formed. Exfoliation or desquamation of the cuticle is mentioned among the external signs of survivorship: this appearance was here wanting. Lastly, certain changes in the umbilical cord are set down as furnishing evidence, not merely of live birth, but of the time

* See Meckel. Lehrbuch der G. M. 354.

within certain limits, that a child may have survived. Thus it is said, that in a child which has not been born alive, or has died immediately after birth, the umbilical cord will be found firm, rounded, thick, of a bluish colour, and more or less spongy to the feel. In about twenty-four hours after birth, supposing the child to live, it becomes shrivelled, and contracted from the point at which the ligature is applied, to where the cord joins the abdominal parietes. From the second to the third day after birth, the cord becomes brown in colour, and dry between the ligature and abdomen: it also acquires a certain degree of semi-transparency: its three vessels are seen flattened, contracted, and containing only a slight filament of coagulated blood. From the third to the fourth day, the colour deepens, and the cord becomes semi-transparent, and more flattened: the umbilical arteries are almost obliterated: the vein is contracted, but pervious. From the fourth to the sixth day, the cord usually separates from the abdomen. Such is the account, given by M. Devergie, of those changes which, it is presumed, will enable a medical jurist to solve the difficult questions connected with live birth and survivorship*.

In the case before us, the portion of cord between the ligature and abdomen was flattened, horny, and transparent; the umbilical vein contracted and dried up, as it were, to a filament of coagulated blood. This is precisely the condition which is laid down, as evidence of a survivorship of three days. It is true, that the examination of the body was not made until thirty-six hours after death; but the cord had been well wrapped up, so as not to be exposed to the free access of air; and I do not apprehend, therefore, that any considerable change had taken place in its physical characters, from the time of death, until the body was examined. We learn by this, that the changes in the umbilical cord follow each other in a manner too uncertain to allow of any opinion being expressed relative to the time which a child has actually survived its birth. Here the average changes of *three days* were met with in a child which had not lived

* Médecine Légale, I. 513.—M. Devergie seems quite sensible of the numerous exceptions to which these rules for determining survivorship are liable.

more than *six hours*. But the point to be examined, is, whether the changes in the cord of this child were such as to allow us to express an opinion that it had been born alive, and had lived after birth. It appears to me that they were. Supposing the child to have been dead when born, the cord would not, I think, have been in the condition in which it was found. It might have become more dry; or, as the weather was warm, it would rather, perhaps, from its being fully impregnated with liquid matter, have passed into a state of putrefaction. It is not probable that in forty-two hours from birth it would have been found dry, hard, and transparent, or that the umbilical vein would have become contracted to a mere filament of hardened coagulated blood, unless the child had lived for a certain time after birth. Experience has, it appears to me, well established, that the changes in the cord of a dead child, within a given period, are, *cæteris paribus*, very different from those which take place in that of a living child. I have, on several occasions, observed a striking difference in the cords of children, exposed for the same period, at the same time, under similar circumstances, when the one was still-born, and the other had survived its birth some hours. The observation, then, of this part of the body may occasionally allow a practitioner to draw a presumption of a child having been born alive, even when the organs of respiration and circulation afford not the smallest evidence of the fact.

This case appears to me to lead to the following conclusions, important in a medico-legal view :

1. That the lungs of a child, which has lived and breathed *six hours*, may sink in water, and present none of the physical characters of respired lungs.

2. That air, from respiration, may be diffused in visible vesicles over the surface, and throughout the substance of the organs.

3. That air, from respiration, may, by very moderate pressure, be forced out from divided portions of the organs.

4. That a survivorship of six hours after birth may make no difference in the fetal condition of the ductus arteriosus and foramen ovale.

5. That the divided portion of umbilical cord may undergo those changes in six hours, which are often not witnessed until after the lapse of two or three days.

6. That these changes sometimes afford evidence of live birth, when all other evidence fails.

CASE 4.

IN this case, the child was a twin of the female sex.

Age, or degree of maturity.

Its body was $17\frac{1}{2}$ inches long. The umbilical cord was attached to the abdomen, about $9\frac{1}{2}$ inches from the vertex;—its point of insertion was, therefore, about an inch below the centre. The hair was tolerably abundant, and long. The nails were not perfectly developed: they did not quite reach to the extremities of the fingers. The skin was universally pale, except that of the face, which was slightly suffused. There was not the least sign of putrefaction about the body. The skin of the umbilical cord presented a red inflammatory mark, about a quarter of an inch from the abdomen. Beyond this, and as far as the situation of the ligature, about an inch, it was yellow desiccated and semi-transparent. The body weighed 27686 grains—not quite five pounds.

These circumstances led to the inference, that the child had not quite reached maturity; due allowance having been made for its being a twin child.

Had it lived to respire?

The chest was small, contracted at the upper part, and flattened anteriorly. Upon laying open the cavity, the lungs were seen somewhat full, and slightly projecting forwards, but not sufficient to cover the pericardium in any part. They were of a deep livid colour, like those of a still-born child: their surface presented, in some parts, minute granular spots of a lighter hue, but still bearing no resemblance to the colour derived from respiration. On firm compression, they were not found to be in the least crepitating, in any portion of their structure.

The heart was unusually large, and the pericardium contained a quantity of serum. The ductus arteriosus was large, of equal diameter throughout, and evidently not reduced

from its foetal dimensions. The aperture of the foramen ovale was situated in the upper and right part of the fossa; the thin membranous partition closing, as usual, about three-fourths of the space; its crescentic margin having the axis of its concavity directed upwards and to the right. Ligatures were applied to the pulmonary vessels: the arteries were small, but they contained blood.

The lungs, when placed on distilled water, with the heart attached, rapidly sank to the bottom of the vessel, the heart turning uppermost. No portion of the lungs seemed buoyant. The lungs, separated from the heart, were found to weigh 675 grains; and the ratio, obtained from Ploucquet's test, was therefore, $27686 : 675 = 41 : 1$.

The specific gravity of the organs was taken, and found to be 1.046;—thus differing, in only a fractional degree, from that of the liver or lungs of the foetus which has not breathed*.

The lungs were now separately placed on water; but they both sank with equal rapidity. Each lung was then cut into fifteen pieces. The substance of the organs was healthy, of a deep Modena-red colour, with here and there patches of a somewhat lighter hue. There was no crepitation under the knife, nor was there any mark of congestion; for no more blood followed the incisions than is ordinarily witnessed in dividing the lungs of a foetus. The pieces of the two lungs having been kept apart, were placed on water separately; and it was remarked, that every portion sank rapidly to the bottom. The lighter-coloured masses were now cut out from the divided pieces, and placed on water; but there was no difference in their specific gravity; they all equally gained the bottom; and, on compression below the surface of water, no bubbles of air escaped.

Probably the answer returned by a medical witness from these data, would have been, that the child in question had not breathed, but that it had been born dead. The fact,

* According to Albrecht Meckel, who has performed many experiments on this subject, lungs that have not respired are $\frac{1}{11}$ heavier than their bulk of water: (*Lehrbuch der G. M.* p. 354.) This would give a specific gravity of about 1.071.

however, was, that this child had not only been born alive, but had survived its birth *twenty-four hours*. No particular remark was made respecting its respiration.

It is true, that the condition of the heart and lungs could not have led to the remotest suspicion of the child having respired, much less of its having lived for so long a period after birth: but we learn from this, what the previous case had already taught us, that active life is not always necessarily indicated by obvious physical changes in the lungs;—in other words, that there are instances in which the ordinary resources of medical science wholly fail to elicit the fact. Unable to explain how it was, that the life of a child could be continued after birth without its lungs becoming permanently distended by the process of respiration, the older medical jurists were accustomed to deny the correctness of reports of this kind: they thought, that there was no better means of defending the employment of the hydrostatic test, than that of meeting all alleged obstacles to its use by a positive denial of their existence. It is needless to say, that this spirit of opposition has long since disappeared: inquirers into these subjects have now found, that the best way to support a doctrine, is to try it by every method of investigation, to shew its defects as well as its excellencies, and to submit it to the most rigorous analysis. Experience has also taught them, that to invest any doctrine with a value which does not belong to it, only gives it a temporary importance, and subsequently exposes it to a total downfall. It often happens, indeed, when fallacies are once shewn to exist in a doctrine, that individuals pass from one extreme of opinion to the other—from credulity to absolute scepticism. Thus, even the cases in which the pulmonary tests might be useful are now lost sight of, in the number in which they have been improperly employed.

A few observations have already been made upon life, as manifested in children under the form of imperfect respiration, in which the lungs, in some part of their substance, retain sufficient air to float, provided they be not congested or diseased. The question is more intricate, however, when we find that the *healthy* lungs of an infant sink, although it may have lived and breathed some time after its birth. The sinking,

in such a case as the present, could not be ascribed to sanguineous congestion or any diseased condition, but to the absolute want of air. In the first place, it is to be observed, the lungs may contain air, and yet be heavier than their bulk of water; since, although the specific gravity of the unrespired organs differs but little from that of water, it requires a certain quantity of air within them, to give them buoyancy. The mere fact of sinking, then, is no evidence of their not containing air; for this sinking will often be observed when they are placed in water entire, while portions will be found to float when they are divided. The case here examined was so far remarkable, that not a single portion, although the two lungs were divided into *thirty pieces*, floated: even the subdivided portions of some of these sank. It is clear, therefore, that not one *thirtieth* part of the lungs of this child had received air: indeed, neither by compression under water, nor in any other way, could I detect the presence of air in any part of them. These cases are ordinarily set down as the exceptions to a very general rule; and perhaps they ought to be regarded in this light: but, at the same time, I cannot help thinking that they are more common than some medical jurists are inclined to admit. In examining the body of a child, the history of which is unknown, it is proper that the possible occurrence of such cases should be well borne in mind. It appears to me not improbable, that many such come yearly before coroners in this country; and that they are dismissed as cases of still-born children, notwithstanding the severe marks of violence which are often found about the bodies. If, as I have already observed, the lungs sink in water, the fact is regarded as sufficient evidence of still-birth. This is assuredly putting the most humane interpretation on the circumstances; and so far the result is not to be objected to: but we should take care, in carrying out this principle, that we do not thus throw obstacles in the way of judicial inquiry*.

* If we take *twenty* cases, in which the deaths of new-born children require the investigation of a coroner, it will, I think, be found, that, at least, *fifteen* of these children are pronounced, by the verdict given either at the inquest or trial, to have been *born dead*. This is equivalent to 75 out of 100.

The time which this child survived was twenty-four hours. Professor Bernt met with an instance, in which a seven-months' child died two hours after birth; and when its lungs were divided and placed on water, every fragment sank*. Remer has reported another, in which the lungs sank in water, both entire, as well as when divided; although the child had survived its birth at least four days†. In this case, the navel-string separated naturally before death. Orfila found, in a child which had lived eleven hours, every portion of the lungs, when divided, to sink on immersion. In three other cases, in which the subjects survived birth, four, six, and ten hours, the lungs also sank when divided: two of these were mature children‡. Other instances are recorded by Daniel, Schenk, and Osiander. Metzger§ supposed that premature children alone were likely to present this anomaly, *i.e.* of continuing to live after birth without leaving any clear signs of respiration in their lungs. Perhaps the greater number of these cases have occurred among premature children; but the observations of Schenk||, Remer¶, and Orfila, satisfactorily prove, that perfectly mature children may also be the subjects of this singular condition. It is of course presumed that there is no cause of disease to render the lungs heavier than water; but that

100. Now what are the real facts? Statistical Tables, extending over a series of years, and embracing not less than eight millions of births, shew that the still-born do not form above $\frac{1}{10}$ or $\frac{1}{12}$ of the total births, *i.e.* not more than from 5 to 6 out of 100. As we might suppose, however, in *illegitimate* births, among which the majority of cases of child-murder unquestionably lie, the average number of still-born is augmented: but, taken over a period of twenty years, in the city of Geneva, these did not constitute more than 12-per-cent of the births. Males are more frequently born dead than females, probably from the greater size of the head and body. In Prussia, the still-born males were to the females, during a period of fifteen years, in the ratio of 1.35 to 1. In Geneva, during a period of twenty years, as 1.33 to 1.—*Brit. and For. Med. Rev. July 1857.*

* Cummin on Infanticide, p. 65.

† Henke. Lehrbuch der G. M. p. 374.

‡ Méd. Lég. I. 375.

§ System der gerichtlichen Arzneiwissenschaft, 403.

|| In Schenk's case, the child weighed 6½ lb., and was nineteen inches in length. It lived four days. Niemann. Taschenbuch der G. A. p. 93.

¶ Bernt. Systematisches Handbuch der gerichtlichen Arzneikunde, p. 243.

their structure resembles that of the lungs of children which have not breathed.

The occasional existence of this state of the lungs of the living child is then placed beyond all dispute: the explanation of the causes upon which it depends—how it is that a child may live and breathe for hours or days, and that no sign of respiration be discovered in its body after death—is involved in great difficulty. The late researches of Dr. Joerg of Leipzig have, however, thrown some light upon the subject; and these may probably lead the way to other discoveries in this obscure department of physiology. Some of Dr. Joerg's views are peculiar. He considers that the act of parturition, as well as the *duration* of the process, has a material influence upon the system of a child; and that they serve to prepare it for the efforts which it has to make in performing respiration. I quote from the analysis of his Paper by Dr. Graves*. “A parturition of the natural duration gradually checks the placental circulation, and limits that of the fœtus chiefly to its own system; while it engenders in the latter a gradually increasing, and, finally, an urgent, want of some new mode of respiration. If the act of parturition be much shorter in duration than is natural, the child incurs the danger of being born in other respects healthy, but not at the moment endowed with the organic stimulus to expand its chest for the purpose of making the first inspiration.” Supposing the first inspirations to be, from any cause, feeble or imperfect, then the organs will become only partially distended: the remaining portions will preserve their fœtal condition. Dr. Joerg considers this as a positively diseased state of the lungs in the new-born child, and he has given to it the name of “*atelectasis*†.” It may proceed from various causes. He considers, that children which are born after a very easy and rapid delivery are liable to it; and thus it may be found in a mature, as well as in an immature child. Any cause which much weakens the vital powers of a child before its actual birth, may give

* “On the Fœtal Lungs in New-born Children.” See Dublin Journal of Medical Science for July 1836. Also, Medical Gazette, Vol. XVIII. p. 604.

† ἀτελής “incomplete”; ἔκτασις “expansion.”

rise to the occurrence of this imperfect dilatation of the lungs. In this way, it may be due to long-continued pressure on the head during delivery, or to hæmorrhage from the cord. All the causes of asphyxia in a new-born child will, when operating only in a very slight degree, also produce this atelectasic condition. When only a part of the lungs becomes, in the first instance, distended, the child may not afterwards acquire sufficient strength to fill the remaining portions: it may thus live on some hours or days, respiring at intervals, and becoming occasionally convulsed, in which state it will probably sink exhausted, and die. The Dr. has remarked, that those portions of the lung which are not speedily distended by air, afterwards become consolidated or hepatized, so that all traces of their vesicular structure are lost. The length of time which the child survives will depend upon the degree to which its lungs have become dilated.

It is not necessary that the whole of the lungs should have received air, in order that a child should continue to live even for some months after its birth. A few years ago I met with the following case, which will serve to illustrate this statement. A child, aged *six months*, had, it was supposed, been destroyed by suffocation. Upon opening the thorax, the viscera were found healthy; but the whole of the inferior lobe of the right lung was, so far as regarded colour, density, and structure, precisely like the lungs of the fœtus; no air having ever penetrated into it. It had become developed in size, but its vesicular structure was perfectly destroyed. When the whole of the lung was placed in water, it floated: but when the inferior lobe was separated, it immediately sank to the bottom of the vessel. I have no doubt that this was a case of *atelectasis*, such as it is described by Joerg. The lobe had not received air in the first instance; and had become afterwards consolidated or hepatized, so that it could not be inflated.

To apply these remarks to the case under examination, I think we must admit, that this child's lungs were wholly in a state of atelectasis; into the probable cause of which it is not here my purpose to inquire. These researches of Joerg shew that a medical jurist, besides attending to the post-mortem appearance in a child submitted to examination, should also, if possible, ascertain whether the delivery has been rapid or not. A knowledge of the facts connected with delivery may sometimes enable him to offer an explanation of this singular condition of the lungs, when it exists in a child which is otherwise healthy and mature.

When the hydrostatic test fails to indicate respiration, it is easy to understand, that all the other signs of an altered circulation will be absent. However long the child may live, the absolute weight of the lungs, as well as the relation of this to the weight of the body, will not vary materially from that of the fœtus. Further, the ductus arteriosus and foramen ovale will retain their fœtal characters: indeed, it is not improbable that the blood continues to circulate through these parts after birth; since the great cause of the diversion of the current of blood, the process of respiration, has not come into full operation. Hence, then, there was not a single medical fact which could have led to the presumption that this child had respired.

We shall now see whether there were any better grounds for presuming that it had been born alive. The state of the umbilical cord was the only circumstance which could be looked to as likely to assist in this part of the inquiry. The skin had a line of inflammatory redness at the point of future separation; and between this and the ligature it was yellow, desiccated, and transparent. But little stress, it appears to me, can be placed upon this *line of redness*, as evidence of life after birth; since it was met with in Case 1. wherein the child came into the world dead. To the desiccation and transparency I think more importance may be attached, for reasons already assigned under Case 3. If we are acquainted with the circumstances under which the child's body has been exposed, we may, from the discovery of these conditions, draw a presumption, that the child has lived after birth; although, it must be confessed, this would

be scarcely admissible in law, unless it were corroborated by other less equivocal evidence. That these slight changes are capable of indicating the period of survivorship, is not to be admitted.

On the whole, this may be set down as another instance, in which, if the child had been criminally destroyed, medical evidence would have entirely failed in shewing that it had lived; although the sinking of the lungs, as I have already observed, would not have entitled the witness to say that the child must have come into the world *dead*. A criminal would have had the benefit of the unavoidable deficiencies which yet exist in this department of science.

The conclusions to which this Case leads, are :

1. That a child may live and breathe for *twenty-four* hours, and yet every part of its lungs, although healthy, may sink in water.

2. That the lungs of a child which has lived twenty-four hours may present all the characters of those organs, as they exist in a child which has come into the world *dead*.

3. That life, protracted for twenty-four hours, does not necessarily alter the condition of the ductus arteriosus and foramen ovale.

4. That there are instances in which medical evidence will not establish that a child has breathed, or survived its birth.

It will be seen, on an examination of the four Cases here related, that three of them are well calculated to shew how inadequate the pulmonary tests are, in some instances, to establish those points which many consider them capable of proving. Of these three cases, one renders it certain, that a degree of respiration, sufficient to give buoyancy to the lungs in water, cannot be demonstrated upon clear and satisfactory grounds;—there being no means of distinguishing it from air artificially introduced. The two last, on the other hand, shew that life may be prolonged for many hours, without the lungs becoming buoyant from respiration. It may be remarked of these tests, but more

especially of that founded on the floating of the lungs in water, that medical practitioners have differed much, at different times, in their ideas of what it was fitted to prove. About fifty years ago, it would seem that the hydrostatic test was regarded, by some, as capable of furnishing evidence of murder. Thus, we find Dr. Hunter asking the question, "How far may we conclude that the child was born alive, and *probably murdered by its mother*, if the lungs swim in water?"* Later authorities, and, indeed, many in the present day, assert that it is capable of proving whether a child has been *born alive* or not. From what has already been stated in this paper, as well as from the most simple reflection on the circumstances accompanying the birth of children, I think it must be evident, that the hydrostatic test is no more capable of shewing that a child has *been born alive or dead*, than it is of proving whether it has been murdered, or has died from natural causes. The majority of those who have made experiments on this subject, have only pretended to shew, by the use of this and the other tests, whether or not *a child has breathed*; and a very slight examination will render it apparent, that, in no case, are they susceptible of doing more. But even here, their utility is much restricted by numerous countervailing circumstances, a knowledge of which is essential to him who wishes to make a practical application of the facts connected with them. If we were asked to state in what cases the pulmonary tests are capable of assisting the medical jurist, I think the answer would be:—1st, They will clearly shew that a newborn child has lived, when, during its life, it has *fully and perfectly respired*. Cases of this description form a certain number of those which come before our Courts of Law. To them, the most serious objections are not applicable: and the few which might be made to the medical inferences are not difficult to answer. 2dly, They will allow a witness

* Op. Cit. p. 28.—The titles of many of the works published before Dr. Hunter's time bear evidence of the mistaken views of the authors as to what the hydrostatic test was capable of proving. In 1722, Heister published a treatise, called "*Programma quo ostenditur ex pulmonis fœtus innatatione vel submersione in aquâ, nullum certum infanticidii signum desumi posse.*"—See Orfila, I. 418. Niemann. Taschenbuch, 87.

to say, that the lungs must have either received air by respiration, or by artificial inflation. These are the cases in which a child has died soon after birth, and where the respiratory changes are but very imperfectly manifested in the lungs. I believe that they form the large majority of those that fall under the jurisdiction of the criminal law. It might be considered, that the qualification in the inference here made, neutralized its force; but it must be remembered, that there are few instances, of *actual and deliberate child-murder*, wherein artificial inflation could become even a *possible defence* for an accused party. So unusual is this kind of defence, that, among the numerous trials for infanticide which have taken place in this country for many years past, I have not been able to meet with a single instance in which it was alleged, in answer to the buoyancy of the lungs, that the prisoner had inflated them in order to resuscitate her child. The reason is obvious: had such a defence been attempted, the whole of the circumstantial evidence would at once have set it aside*. When, in the suspected murder of an adult, a medical man swears that a fatal wound was such, as that the deceased might have inflicted it on himself, or that the prisoner might have produced it, he is placing the jury in a very similar position to that in which he places them in a case of child-murder, when he says that the child might have breathed, or its lungs might have been artificially inflated. How would a jury decide in the two cases? Assuredly, by connecting together certain facts with which a medical witness has no concern, but which may, in their opinion, satisfactorily supply the place of what is defective in his evidence. It is not for him to calculate the probabilities of respiration, or of artificial inflation; but it is for them to consider, whether an accused party was likely to have resorted to an experiment of this nature. The hydrostatic test ought not, therefore, to be lightly condemned, or rejected, upon an abstract objection, which, in nine-tenths of the cases of child-murder, could not possibly exist. Let it be granted to the fullest extent, that a conscientious medical jurist cannot

* See Niemann. Taschenbuch der G. A. 89.

draw a positive distinction between respiration and artificial inflation—still, the jury may be in a situation to relieve him from the difficulty. In short, it would be as reasonable to contend that all murderers should be acquitted, because *homicidal* are not always to be distinguished from *suicidal* wounds, as to argue that all cases of infanticide should be abandoned because these two conditions are not to be known from each other by any certain medical signs. If juries do frequently dismiss such cases, it is, I apprehend, to be ascribed rather to their great unwillingness to become the means of administering very severe laws, than to their want of power to balance and decide on the probabilities laid before them. The 2d Case related in this paper may be taken as a fair example of the doubtful condition in which the lungs will be found, in numerous investigations respecting infanticide.

Cases 1, 3, and 4, represent a peculiar class. They are beyond the reach of the pulmonary tests; because the lungs do not receive and retain a perceptible quantity of air, although, as in 3 and 4, the subjects may have lived some hours. The hydrostatic test is no more capable of shewing that such subjects as these have lived, than it is of indicating from what cause they have died. The facts have been already sufficiently commented on. Cases of this kind, although not so common as the preceding, demonstrate that existence may be for some time continued under a state of the respiratory process, not to be discovered after death. In the opinion of many, these cases form a serious objection to the tests: but it is difficult to understand how they can affect the application of them, in the instances alluded to; or why, because signs of respiration do not always exist in the lungs of children which have lived, we are not to rely upon them when they are actually found. Poison is not always discernible after death, in the stomach of a person who has taken it; but this does not prevent a medical jurist from searching for it, and relying upon its discovery under proper cautions, as evidence of poisoning in any other case.

These singular instances prove that we are greatly in want of some sign to indicate life after birth, *when the marks of respiration are absent*. Until we discover this,

we must of course make the best use of that knowledge which lies at our disposal; taking care to apply it to those cases alone to which experience shews it to be adapted. In the mean time, the inference that a child has been born dead because its lungs sink in water, although not physiologically correct, is never likely to implicate an innocent party: it may sometimes cause the liberation of the guilty. But to recommend the abandonment of the pulmonary tests on this account, would be equal to proposing that the whole code of criminal law should be repealed, because it does not always succeed in convicting and punishing those who have infringed its provisions.

If the pulmonary tests were wholly set aside, it is easy to conceive what would be the consequences. Thus, let us suppose that a new-born child is found, under suspicious circumstances, with its throat cut;—we are called upon to say that it is impossible for medical evidence to establish whether the child had lived or not, and therefore we are to decline making an inspection of its body. But this would be the same as declaring that child-murder could never be proved against an accused party, and that new-born children might henceforth be destroyed with impunity. It appears to me, that conduct of this kind, on the part of a medical witness, would be wholly unwarrantable; for we may sometimes acquire, by an inspection, as great a certainty of respiration having been performed, and therefore of a child having lived, as of any other fact of a medico-legal nature. Cases of poisoning often give rise to greater difficulties to a medical jurist; as where, for example, he attempts to found his opinion of the cause of death on symptoms or post-mortem appearances. But we will put the question in this light. In the body of a healthy full-grown child, which has but recently died, we find the lungs filling out the cavity of the chest, of a light-red colour, spongy, and crepitant beneath the finger, weighing at least two ounces, and, when divided into numerous pieces, each piece floating on water, even after violent compression. Is it possible in such a case to doubt that respiration had been performed? If there be no certainty here, it appears to me that medical experience is but little fitted to guide us in our inquiries.

It would be difficult to point out an instance in which an affirmative medical opinion would be more surely warranted by the data upon which it was founded.

Again, it has been contended, that the difficulties accompanying the tests are of too delicate a nature for a practitioner to surmount;—that they are only serviceable in the hands of those who have had frequent opportunities of experimenting. Even admitting this reasoning to be true, the inference rather forms an objection against those who employ the tests, than against the tests themselves. On the same principle, the analysis of poisons would have been long since abandoned to a few. A very short experience has however shewn the injustice of this view, in regard to Toxicology; and I feel certain that a few years will prove it to be equally unfounded in relation to Infanticide*.

* * For the best and most impartial summaries of the merits of the Pulmonary Tests, I must refer to Meckel. *Lehrbuch der gerichtlichen Medicin*. Halle, 1821. Also to the *Cyc. Pract. Med.*; Art. *Infanticide*.

CASES
OF
GANGRENE, ANEURISM,
UN-UNITED FRACTURE, HERNIA,
WOUND OF THE TONGUE,
AND STONE IN THE BLADDER.

BY MR. BRANSBY COOPER.

GANGRENE OF THE HAND.

Reported by Mr. JOSEPH WILLIAMS.

SAMUEL HARLOW, aged 18, five feet three inches high, with brown curling hair, and dark complexion, was admitted into **Cornelius Ward**, under the care of Mr. Cooper, with dry gangrene of the hand. During the last seven or eight years, his health has been very good; with the exception of occasional slight cough, which occurred more especially during the last winter; and at that time his expectoration was frequently tinged with blood. There was no difficulty however in breathing. But too much importance must not be attached to these facts; as, upon further inquiry, he states, that his nose bled frequently about that time; so that the mucous membrane of the nose might have been the source of the colouring of the expectoration. These symptoms recurred when he caught cold, continuing two or three days, and then subsiding. He has never been strong nor stout. In the early part of his life, his health was by no means good, although he had no particular local affection. During the past summer, his health has been excellent. His diet has been good—meat, and a pint of porter daily. About three weeks before his admission, whilst planeing a piece of wood, he struck, with considerable force, the end of the nail of the right ring- or third-finger, against a piece of lead placed upon the wood to steady it. This blow gave him pain at the root of the nail, shooting up the arm: after a short

time, however, it became comparatively easy, and did not interfere with his work for more than a few minutes. On the following day, the root of the nail, and the skin for about a quarter of an inch above that point, had a bruised appearance, and felt cold and numbed, with little pain in the part; no swelling, pain, or tenderness up the arm or in the axilla; and he continued his work as usual, feeling himself quite well. He did not at the time apply any thing to the finger. This bruised or ecchymosed appearance, and the other local symptoms, did not appear to extend; but on the third day from the accident, the palmar aspect of the fore and middle fingers became gradually numbed, cold, and shrivelled, and whiter than the healthy fingers; and also very tender and painful, the pain being confined to the end of the fingers. The ring-finger, the original seat of the injury, now became affected above the parts which had the bruised appearance, and seemed inflamed as far as the second joint. In about a week, these local symptoms (without deranging his general health) extended, in all the fingers, as far as the second joint. At this time, when immersed in warm water, they lost their pale or white appearance, and became blue, and more painful. They again resumed their death-like appearance, upon removing them from the artificial heat. He applied a small poultice to the third-finger, which was then black and dry near the root of the nail. In a day or two there was a discharge of a thin yellow matter mixed with dark blood. His health continued as usual; and he still attended to his employment, experiencing, at times, severe pain in the course of the median and external cutaneous nerves. He was at length obliged to give up work. Four days before his admission, the thumb began to manifest precisely the same symptoms as the fingers had done, and in the same succession; viz. loss of sensation, coldness, pain, tenderness, and that blue appearance; and on the following day (that is, three days since) the little-finger assumed the same condition. The following medicine was ordered:

Pulv. Opii gr. $\frac{1}{2}$. Syrup. q. s. ft. pil. o. n. s.

Subcarb. Ammon. \mathfrak{z} i. Spt. Lavand. comp. \mathfrak{z} ss. Aq. puræ

\mathfrak{z} xij. Sacch. alb. \mathfrak{z} ss. ft. mist. Sumat coch. amp. ij. ter die.

Liquor. Ammon. Acet. \mathfrak{z} vj. Spt. Vin. rect. \mathfrak{z} ss. m. ft. lotio.

This gave him slight relief of the pain in the hand and up the arm; but he says he has not had one good night since the accident. His sleep is short, and disturbed; and when he awakes, he feels what he terms "rather light-headed." He has, occasionally, perspirations; and has been losing flesh for the last week, although his appetite has been good, and he has taken porter daily.

Oct. 7. He was admitted into the hospital this morning. His aspect is exsanguineous, and feeble, with a countenance of depression. There is a general sense of coldness over the whole body, but more particularly the feet and hands; the centre of the tongue is white, and thickly furred; but this condition gradually diminishes towards the tip, where the papillæ are red, and rather prominent. Pulse, at the left wrist, 92 in the minute, full and large, with a sharp impulse, easily compressed: no pain in the head or back: no sickness: appetite pretty good: bowels open. He had very little sleep last night; which he attributed, partly to the novelty of his position in the hospital, but chiefly to the pain in the arm below the elbow and in the hand: this pain he thinks is increased when he lies down, which induces him to rest with pillows to support his head and back.

The fingers and thumb present a livid hue, extending up the palm of the hand: this livid aspect is not intense at the extremities of the 1st, 2d, and 3d fingers, but at the other parts. The skin has a deep-mottled appearance; the fingers are cold as high as the first phalanges, and swollen; but the end of the finger which received the original injury is shrivelled and black, and in the condition of dry gangrene. He has no sensation on the dorsal aspect of the hand below the first phalangeal articulations. The sensation of the parts supplied by the cutaneous branch of the median remains pretty good, but no where so good as in the other parts of the body. Below the palm, the sensation is lost, except on the little and ring finger, where pressure may be felt. The brachial artery, at the upper part, feels somewhat cord-like, apparently from the thickening of its coats; and, on tracing it downwards, it becomes more so; and the pulsation, after gradually diminishing, ceases at the elbow, about two inches above its division into ulnar and radial,

where it appears solid, without pulsation. The solid condition may be traced along the two first inches of the radial artery, where it disappears; but it is again recognised about three inches above the wrist; and from that point continues so, throughout its distributions, as far as they are tangible. No pulsation can be felt in the ulnar artery: it also feels solid from below the wrist, to about three inches above: and just above where the solidity terminates, he complains of severe pain when the course of the artery is pressed upon: there is a slight fullness in the arm, to the outer side of this tender point. Pressure along the course of the median nerve induces the same sensation. An absorbent gland, above the internal condyle, is enlarged, but not tender to the touch.

The respiration through the upper part of the right lung is quite free; the murmur throughout distinct; sound, on percussion, good; the action of the heart, and of the large vessels arising from it, healthy. The circulation through the arteria-innominata and right carotid appears quite free; but, upon examining the subclavian on the same side, about an inch to the outer side of the scalenus muscle, a distinct rough sawing noise is heard in the artery, from some obstruction to the flow of blood. This noise is increased by pressing the stethoscope upon the artery, so as still further to diminish the caliber of the vessel; and again diminished to the sawing noise, as soon as the pressure of the stethoscope is removed. A small enlargement, probably a gland, is felt under the artery, which appears to be pressing the artery forwards. This vessel is evidently much nearer the surface on this side than on the left. The superficial thoracic branches, and an artery close to the inner side of the coraco-brachialis, are obviously larger than on the opposite side. The skin on the palm of the hand has not, as yet, participated in the livid character of the fingers and thumb. There is no attempt, at present, at a line of separation between the healthy and diseased parts.

Some house-medicine was ordered, which acted freely on his bowels. Mutton-chops.—A pint of port^r daily.—Flannel to the hand, arm, and as far as the shoulder.—The head to be inclined to the right side; to relax, or loosen, as much as possible, the cellular tissue and cervical fascia; and thus

to aid the removal of all pressure from the enlarged gland.

Hyd. Subm. gr. i. Pulv. Opii gr. i. m. fl. pil. h. s. s.

Oct. 8. Pulse 104, harder and sharper than yesterday: tongue furred, as yesterday: has slept very little during the night: no respiration or shivering: no pain in the head or chest. Respiration not hurried; quiet and free; no pain in the back, and expresses himself as feeling more comfortable to day. The warmth of the whole body seems to be uniform and natural. He has had severe shooting in the hand, with a sense of general tightness as high as the wrist, both before and behind. The tenderness above the wrist continues, and the sensation in the palm is diminished. The obstruction to the blood in the subclavian artery much the same. Chops and porter continued: bowels open once.

Sumat Tinct. Opii m. xv. Mist. Camph. ʒ iss. horâ somni.

Oct. 9.—8 A. M. He has passed a restless night, dreaming much, with short sleeps; and has felt somewhat chilly: pulse 128, smaller, but harder than yesterday: tongue more furred, and a little red at the apex: no dryness of the tongue; no headache or pain in the back: urine copious, and light-coloured: bowels open once: hand not quite so much swollen, nor so livid about the wrist. The pulsation in the brachial artery cannot be felt so low as yesterday, by about an inch;—this is recognised by an ink-mark made upon the arm: no pain in the axilla, nor in the gland (or swelling) above the clavicle; nor has there ever been any tenderness at this point, the patient not having been aware of its existence.

Rep. haust. Opii.

Sumat Mist. Mag. c̄ Mag. Sulph.—Diet the same.

10. He has passed a better night: pulse 110: the bowels open four times yesterday. He feels more comfortable to day: his countenance is more lively: the hand a little more swollen, and slightly œdematous. The distribution of the cutaneous veins of the fore arm is marked by purple lines, resembling, in a mild degree, the cadaveric transudation from the veins. The veins are empty, or contain very little fluid blood: the pain, which was confined to the hand, has extended to two inches above the wrist. The defined tenderness in the middle of the fore-arm is less, and the slight swelling has disappeared. Tongue as yesterday: appetite not quite so good. He thinks he can recline more, and with less inconvenience to his head and arm; but the pain is always increased by making the attempt; and the pulsation above the clavicle is more distinct.

Rep. omnia.—Sumat Mist. salin. ter die.

Oct. 11. Pulse 120, sharp and irritable: bowels opened twice: no shivering: a little perspiration in the night, about the face: no pain in the head: tongue less furred. The hand continues painful; and in other respects the gangrene appears slowly extending. The venous marks are more distinct, and extend higher than yesterday; there is an extensively-diffused dull red appearance, and the tenderness, on pressure, is extending up the arm: the fingers more shrivelled: appetite good; aspect lively; temperature about the wrist and forearm good, but rapidly decreasing on exposure to the air. The enlarged branches of the thoracic arteries, which were distinguished on the 7th, cannot be felt so distinctly as at that time; and the pulsation of the brachial ceases a little higher up. He seems more drowsy.

12. He has had a better night. Pulse 128: bowels opened once: feels rather thirsty, otherwise much the same: spirits good.

13. He has slept well: rather profuse perspiration over the face and neck, continuing about ten minutes. No pain in the head: bowels open: more thirsty: tongue cleaner: pulse 124, sharp and irritable: appetite good: hand not quite so painful: the pain does not extend more than three inches above the wrist. The venous lines are distinct, and coloured as high as just above the elbow-joint, presenting a dark-red appearance, corresponding to empty veins. The other symptoms are much the same. In the evening he complained of a great deal of sickness at the stomach. He was ordered the following mixture:

Sumat Tinct. Humuli ʒifs. ċ Mist. Efferves. ʒifs. quâque quartâ horâ.

14. He has passed a very restless night. He was early this morning troubled with slight hiccough. Pulse 110, sharp and irritable. He complains much of pain in the hand. The porter discontinued.

Rep. Mist. Efferves. ċ Tinct. Humuli.

Sumat Tinct. Hyosc. m. xx. Mist. Camph. ʒifs. hora somni.

15. He seems a little better this morning; but complains of great pain in the arm and hand, and is troubled with occasional sickness. Pergat.

16. Pulse 116, sharp and irritable: tongue cleaner: no pain in the head: has passed rather a bad night, in consequence of extreme pain in the hand: appetite good: bowels opened once to-day. The same obstruction to the passage of blood through the subclavian is to be recognised by the stethoscope. Respiration good. The brachial is now obstructed at least four inches above the division. The

gangrene is slowly extending. The ring-finger is black and shrivelled. There is a fœtor from the hand. The back of the hand is tense, and œdematous; and presents a waved line, extending obliquely across the hand, and somewhat white: and below that line the hand is cold and darker, as if there was a very feeble attempt at the line of separation: the heat of the limb is better maintained after exposure above the line than below it. The sensation in the palm is now imperfect: about two-thirds down, and below that, there is no sensibility to pressure. The venous lines on the back of the hand are distinct, to just above the elbow.

Rep. Mist. Efferves. c̄ Tinct. Humuli.

Sumat Morph. Acet. gr. $\frac{1}{4}$. horâ somni.

17. He has passed a very bad night, from the pain in his hand. Free perspiration after taking tea or any warm fluid: bowels rather relaxed: pulse 108, sharp, and irritable: tongue not at all dry, but furred: no thirst: local symptoms much the same: the gangrenous fœtor stronger, and a thin offensive discharge from the ring-finger. —Porter &c. to be continued.

Sumat. Morph. Acet. gr. $\frac{1}{3}$ horâ somni.

18. He has passed a rather better night; but the hand is very painful, more so than ever before. Tongue nearly clean: pulse 120, irritable: skin rather hot: no perspiration or thirst: appetite not so good. He was not able to eat his chop. Bowels opened three times: the pain confined to the hand.

Pergat.—Rep. pil. omni nocte.

19. He enjoyed his meals. Tongue clean: bowels opened twice: his countenance rather anxious: no sickness or hiccough. He complains of great pain in the hand, and lower part of the fore-arm; both of which are swollen, and pit upon pressure. The lines marking the course of the veins are still very evident. The pulsation of the right brachial is still feeble, and much the same as at the time of the last report. He still prefers the sitting posture.

Rep. omnia.

20. The cuticle, just above the two first metacarpo-phalangeal joints, is of a greenish hue. Tongue clean: appetite good: skin moist. He slept better last night than he has ever done since his admission. Pulse 114, rather irritable. Bowels opened once to-day. He has not so much pain in the hand as yesterday. His countenance is improved. Ordered stale beer-ground poultice to the hand.

Rep. omnia.

21. He has had a pretty good night. Complains very much

this morning of pain in the hand, which has been, in his own opinion, increased by the application of the poultice. This, therefore, was laid aside, and a bread-and-water one substituted. Bowels open: tongue clean, and skin cold: pulse 100, compressible. The gland in the neck the same as before; if any thing, slightly diminished. The pulsation of the subclavian artery much the same. The hand is of a darker colour; and the cutis is becoming detached from the fingers. The sanious discharge is increased. Just above the gangrenous spot the hand looks much inflamed. No distinct line of separation, however, is yet observable.

Rep. omnia.

22. He has passed rather a restless night. Pain in the hand excessive. Pulse 96, compressible: tongue clean: bowels opened twice: skin moist: countenance rather anxious: appetite good. The gland above the clavicle is rather diminished. A line is seen just above the metacarpo-phalangeal joints of the first and second fingers, on the dorsum of the hand.

Sumat Morph. Acet. gr. $\frac{1}{2}$. om. noct.

A port-wine poultice was applied.

23. He has had a very good night: hand not so painful. In other respects, much the same as yesterday.

Rep. omnia.

24. He has passed rather a bad night, in consequence of very severe pain in the hand, just above the line of separation, where it looked red and inflamed. Stale beer-ground poultice substituted for port-wine poultice. Pulsation of the brachial much the same. The gland above the clavicle rather diminishing: tongue clean: appetite good: bowels opened once last night: pulse 104, compressible.

Rep. omnia.

25. He did not get much sleep: complains of pain in the hand. Upon removing the poultice this morning, about a table spoonful of foetid sanious discharge escaped, from beneath the cuticle on the palmar aspect. In other respects, much the same.

Rep. omnia.

26. He has had a pretty good night: the line of separation has extended across the dorsum of the hand, as far as the metacarpo-phalangeal joint of the little finger: in other respects, the same as yesterday. The pulsation of the brachial and subclavian arteries unaltered: pulse 94, rather full and compressible: bowels open: tongue clean.

Rep. omnia.

27. In the early part of the night he had a great deal of pain in

the hand, especially the palm ; but about midnight it went off, and he slept well till the morning. The cuticle being detached, excepting by a few threads, it was removed ; and underneath it was observed a distinct line of separation, almost corresponding to the one on the dorsum. The brachial and subclavian arteries much as yesterday. Bowels open : tongue clean : appetite good : pulse 96, compressible.

Rep. omnia.

28. He has had a very good night, and his countenance appears very greatly improved. This morning he experienced a burning sensation in the palm of the hand, and in the line of separation. Tongue clean : appetite good : bowels not open yesterday : pulse 98, full and compressible : skin cold. The gland above the clavicle rather reduced, and the peculiar pulsation in the subclavian artery less distinct : the brachial much the same.

Ordered three ounces of port-wine, daily.

29. He has passed a tolerably good night : hand not so painful, but he feels a burning sensation on the palm. The separation of the dead from the living parts, going on very rapidly : health the same : pulse 96 : bowels opened once.

Rep. omnia.

31. He has had a restless night, in consequence of being disturbed by a patient suffering from delirium tremens in the same ward. His health is gradually improving. The process of separation still goes on very rapidly ; the bones and tendons only being left, as a bond of union. The gland about the clavicle much the same ; but the pulsation of the subclavian still retains a peculiar thrill.

Nov. 2. His countenance and general health gradually improving. The process of separation is going on, and granulations may be observed. The brachial and subclavian arteries much the same as in the last report.

7. Up to this time, his health has been gradually improving. Bowels open : tongue clean : skin moist : pulse 100 : appetite good : the hand is fast separating. The gland above the clavicle remains much the same, and the pulsation of the subclavian and brachial arteries continues as in the last report.

10. His health is now much improved. His pulse is 78, full and compressible : bowels have not been opened to-day : appetite good : tongue clean : no change in the pulsation of the arteries or in the diminution of the gland.

11. He has had a very comfortable night, and enjoyed good sleep. Bowels have not been opened since the day before yesterday : tongue clean : pulse 96, full and compressible : he has not suffered

from any pain in the head, or sickness. He has taken his porter, port-wine, and chops. Mr. Cooper removed the hand at the radio-carpal joint, performing the operation in the following manner:—The fore-arm and hand being fixed, by an assistant, in the prone position, an incision was commenced half an inch below the styloid process of the ulna, which was continued along the dorsum of the hand outwards, in a curved direction, to half an inch below the styloid process of the radius. The flap thus formed was dissected back, and the extensor tendons divided close to the base of the everted flap: the arm was then forcibly supined, when a similar flap was formed on the palmar aspect of the hand; and being reflected in a similar manner as the dorsal flap, the flexor tendons were divided. The third step of the operation consisted in placing the hand and fore-arm between supination and pronation, with the radial aspect upwards. The external lateral ligament was then cut through, and the catalin was insinuated between the radius and scaphoid bone of the carpus; and being directed downwards and inwards, the knife cut its way out of the joint, by dividing the internal lateral ligament below the interarticular cartilage; thus leaving the inferior radio-ulnar articulation uninjured;—which was a principal object in Mr. Cooper's mind, that pronation and supination of the radius might be retained. No arteries required to be tied, as the radial and ulnar were filled up with coagula; although the anastomosing branches bled sufficiently freely to lead to the hope that the stump would heal. The flaps were closely adjusted; the stump dressed; and the patient was put to bed.

12. During the fore part of the night he had the sensation of considerable pain in the hand; but about three o'clock this morning it subsided; and he slept well till nine o'clock, when he took some broth, and again went off to sleep. He was twice sick in the early part of the night; and was so three times to-day: the fluid thrown off the stomach was yellow and watery. The skin is very hot: pulse 106: tongue furred in the centre, but red at the edges: his appetite is bad: his bowels have not been relieved: his arm feels free from pain.

Sulph. Mag. ʒi. Aq. Menth. Pip. ʒi. quaque tertiâ horâ sumend.

13. He slept pretty well last night. His bowels have been relieved twice by the medicine: tongue furred: he has not been sick since he took the last medicine: pulse 98, full and compressible. He suffered slight pain in the wrist, and up the arm, and the stump begins to have a very offensive smell. Since the operation, the gland above the clavicle has become very much reduced in size, and the pulsation of the subclavian artery much more natural.

14. He has passed a very comfortable night: he has had no return of sickness. His appetite has rather improved: tongue furred: skin warm and moist: pulse 90, full: the pain in the wrist and arm much diminished: the stump is more offensive than yesterday: the enlargement above the clavicle has nearly disappeared, and the pulsation in the subclavian artery much more natural. He is able to lie more upon his back; but keeps his head very much raised. His bowels were opened twice yesterday. This afternoon the stump was dressed: there was not the slightest attempt at the adhesive process; but suppuration, to some considerable extent, was going on, and healthy pus was secreted.

15. He has had a good night; has not suffered from headache or sickness. Appetite good: pulse 80, full: skin hot: the gland above the clavicle can hardly be distinguished: the pulsation of the subclavian the same, but of the brachial artery more perceptible: no pain in hand or arm.

17. The stump has become more offensive: it was dressed this morning, and the process of suppuration is going on very well.

18. Complaints of the sensation of slight pain in the hand: appetite good: pulse 105, rather hard: tongue rather furred.—Pergat.

19. Has passed a very comfortable night. He does not look quite so well to-day: pulse 108, hard: tongue furred: appetite good: bowels not open since the day before yesterday, although he took some castor-oil last night. He was ordered an enema; but it was not given, as his bowels were relieved three times in the afternoon: the gland has disappeared, and the pulsation of the subclavian artery is much more natural.

24. He has continued to improve gradually. The wound is healing fast.

Dec. 6. He continues to improve; and the stump is dressed daily, which is now nearly healed. Upon careful examination, the profunda artery appears very much enlarged, and may be distinctly felt pulsating; and the radial also has resumed its function, although the pulsation in it cannot be felt so distinctly as in the left wrist.

He was discharged from the hospital, quite cured, on the 6th of January 1837.

In taking a retrospective view of the history of this case, it is found to be involved in considerable difficulty, to decide whether the gangrene depended upon a general constitutional derangement of the circulating system, or upon the

local injury: perhaps, however, it may be considered, that both of these circumstances led to the subsequent disease. It is to be observed, that before the patient had hurt his finger, he had frequently complained of coldness and numbness of the extremities; and that many symptoms which he described, led to the supposition of a weak condition of the arterial system. And it is further related by his parents, that he always required much nutritious diet, and unusual care, to preserve his general health, which has from infancy been delicate. It seems, that while following his usual avocation as a carpenter, he struck his finger; producing, however, but an unimportant contusion; and was enabled, in a short time, to resume his work;—proving, that to a healthy individual the injury sustained would have been little else than a momentary smart. In him, however, the slight blow soon led to dangerous effects, and inflammation extended to contiguous parts: not, indeed, attended with the usual symptoms of pain, swelling, and tenderness, but, on the contrary, the injured finger was cold and numbed, evincing a slight degree of reparative power. It was at this stage of the disease, I believe, that some slight degree of absorbent inflammation extended up the arm, and led to glandular enlargement in the axilla and above the clavicle: in the latter position, a tumor, like an enlarged gland, was soon discovered behind, but pressing upon the subclavian artery, which in itself might have been sufficient to lead to inflammation of its internal coat, the effusion of lymph, and its ultimate obliteration. It is difficult to believe that inflammation of the artery should extend from the hand up to the axilla, without much more constitutional irritation, and the loss of the whole limb from sphacelus; for, in that case, the obliteration of the vessels would have extended successively from below upwards; while, on the contrary, here the cessation of pulsation was from above downwards: and therefore we have more reason to believe that the disease in this boy was induced by pressure upon the artery, rather than by any specific disease of its internal coat; although, perhaps, it cannot be denied, from the peculiarity of his circulation, that there was some constitutional tendency to sub-acute arteritis.

POPLITEAL ANEURISM.

In April last, I was requested to visit Signor L. Marani, an Italian gentleman, of about 30 years of age, of a dark complexion, but of a nervous temperament; who consulted me in consequence of a small aneurismal tumor, situated in the lower part of his left popliteal space; and which had increased so much in size in the last few days, that he was induced to seek professional advice. Upon examination of the limb, I was surprised to find a cicatrix in the usual situation for tying the femoral artery; and upon inquiring into the history of the case, he detailed to me the following account:—

“In August last, while at Manchester, I perceived a throbbing swelling in my ham, which gave me considerable alarm; although it was quite by accident I discovered the lump, while pulling on my stocking: it gave me no pain; but still I felt a mental impression of its importance, and therefore consulted Mr. George Greeves of Manchester; who immediately explained to me the nature of my complaint, and that the only means of relief was by a surgical operation; to which I consented;—and after preparing me, early in September he operated upon me, in the presence of two other medical gentlemen. Since which operation, I have constantly experienced pain in the whole limb, especially on the inner and lower part of the thigh, but extending also down the leg: at times, this pain is so severe as to be almost unbearable. The swelling in my ham never subsided, although it somewhat diminished in size after the operation.”

To Mr. George Greeves I am indebted for the following account:—

“In September last, I was consulted by Signor Marani, whom I found labouring under a popliteal aneurism; and for whom I tied the femoral artery in the usual situation, in the presence of Mr. Wilson, and another medical friend in this town. The case did remarkably well; so far as the division of the artery, the separation of the ligature, and the speedy healing of the wound, can constitute a successful operation:

though it has not, I am sorry to say, proved a perfectly successful case, there being still a small pulsating tumor in the situation of the original sac. There were some peculiarities in the case, which I ought to mention: one was, the early return of pulsation in the tumor, which occurred within twelve hours after the operation; although, when the ligature was tightened during the operation, the pulsation ceased entirely, and the sac instantly became almost imperceptible; proving, I think, that it could contain few or no coagula. Another peculiarity was, that the circulation in the limb below the ligature became almost immediately re-established: the temperature fell but little at first; and afterwards, never rose above the natural standard. Sensation also was far less interfered with than I have observed it to be in other cases; and I have positively seen more disturbance of the circulation in the hand and fore-arm, from the tightness of a bandage after venesection.

“That the femoral artery was tied, I have no doubt whatever: and Mr. Hunt, my colleague, who is an excellent anatomist, as well as Mr. Wilson, my assistant, declare, that if ever they saw a ligature put upon an artery, it was in this case. I can only conceive two modes of explaining the return of the disease; namely, extraordinarily free anastomoses, or an irregular distribution of the vessels of the thigh. To the former opinion, most of my friends are inclined; but Mr. Cussack of Dublin, who saw my patient when Signor Marani was obliged to make a visit to Dublin, leaned to the latter.

“While in Dublin, the pulsation of the tumor increased so much, that Signor Marani begged of me to pay him a visit: where I met Mr. Cussack, who told me, that he, as well as some of his friends, thought the peculiarity of the case depended upon a high division of the femoral artery into two trunks, which united somewhere above the knee; and he referred me to a preparation in the College Museum, where this peculiarity certainly existed;—one of the trunks being very small, but uniting with the femoral artery just where it becomes popliteal.”

From this history, I was induced to make a very strict

examination of the limb: and upon close investigation, in the course of the cicatrix I could discover the pulsation of a vessel, but certainly not of a healthy or natural-sized femoral artery; nor did any degree of pressure upon this trunk or branch command the pulsation of the aneurismal tumor. In the lower third of the thigh, just where the femoral artery perforates the tendon of the adductor-magnus muscle, the pulsation of the artery was very perceptible; and pressure here immediately stopped the flow of blood into the tumor. I must, however, confess, upon recollection, that I did not keep up this pressure a sufficient length of time to ascertain whether, by delay, anastomosing vessels might not have supplied the tumor; but took it for granted, from this experiment, that a ligature applied to the femoral artery, just where it becomes popliteal, would lead to a radical cure of the disease.

I described to Signor Marani the probable circumstances which had unavoidably led to the failure of the last operation; and proposed to him the application of a second ligature, as the only means of relieving him from his present situation; to which he readily consented. I, therefore, immediately began to prepare him for the operation; which I performed, on the 18th of March 1837, in the following manner, in the presence of Mr. Balderson, Mr. Birkett my apprentice, and Mr. Cuthbert my dresser.

I placed my patient in the same position as for tying the femoral artery in the usual situation; and commenced my incision at about the middle of the inferior third of the thigh; carrying it upwards, to about the centre of the middle third; taking the line of direction towards the centre of Poupert's ligament, and parallel with the tendon of the adductor-magnus muscle, which could be readily felt and seen by slight abduction of the limb. This incision exposed the fascia-lata; and the only difficulty in this step was to avoid wounding the saphena-major vein. The fascia-lata was next divided to the same extent; and the sartorius muscle exposed, which was drawn downwards, or posteriorly, exactly in the contrary direction to which it would be drawn in the upper operation. The aponeurosis extending from

the tendon of the adductor-magnus to the vastus-internus muscle could now be seen, and lying upon it the saphenus nerve: the next step was to open this fascia, which forms a kind of sheath to the artery. Under common circumstances, the division of this sheath immediately exposes the artery; but in this case, I had still to continue my dissection considerably deeper, to separate the tendon of the adductor-magnus muscle from its connexion with the femur, to enable me to get into the popliteal space, before I could secure the artery; which I accomplished, but with considerable difficulty. Immediately the ligature was applied to the artery, the pulsation in the tumor ceased, but in a few minutes became again as distinct as before the operation; and I feared that the second operation would have proved of as little avail as the first. Nothing further, however, could possibly be done; as, by examining deeply into the wound, I could not discover any other artery; although still, if I pressed upon the femoral above the wound, I could command the pulsation in the aneurismal tumor. I therefore dressed the wound; applied a slight compress upon the sac; placed the limb, in a flexed position, upon a pillow; and left the patient as comfortable as could be expected after so severe an operation. He remarked, that he had already entirely lost the painful sensation in the limb, which existed prior to the operation.

At half-past 2, being three hours after the operation, Mr. Cuthbert, my assistant, sent me up the following report:—"Signor Marani has been exceedingly quiet since the operation; the pulsation can be felt in the femoral artery, as low as the wound; and upon slight pressure being made on the aneurismal sac, over the compress, its pulsation can be felt. The pulsation in the anterior tibial artery is very indistinct; but in the posterior, none whatever can be discovered. The temperature of the limb is slightly above that on the opposite side: he complains only of smarting pain in the wound; and in all other respects expresses himself as being comfortable."

4 o'clock P. M. He complains of considerable pain in the limb. The pulse full, and bounding: tongue white; and the skin hot: slight oozing of serum from the wound: the pulsation to be distinctly felt in the tumor, even through the compress.

At 9 P. M. Pulse as quick as in the afternoon, but much less bounding: the skin moist: the tongue white, and countenance anxious: the limb of its natural warmth.

Hyd. Subm. gr. iſs. Pulv. Opii gr. ſs. ſtatim ſumend.

19th.—9 A. M. He has passed a very restless night, and suffered much pain in the back and loins, as well as from throbbing of the wound: the pulse full, bounding, and rapid; but compressible: tongue white, and loaded: the skin moist: the pulsation in the tumor less perceptible. From the state of the pulse and suppression of the secretions, I was hesitating whether or not I should abstract blood from the arm; but when I considered the probability of a protracted illness, I feared that the loss of blood might too much lower his constitutional powers; and ordered him to continue his calomel and opium, and take the following mixture:

Sulph. Magnes. ʒſs. Liq. Ammon. Ac. ʒiſs. Liq. Ant. Tart. ʒiſs.
Tinct. Hyosc. ʒſs. Aquæ Menth. vir. ʒviſs. ſumat cocti.
ampla dua quâque tertiâ horâ, donec alvus responderit.

12. The pill has already produced a quiet state: the pain in the back, and throbbing in the wound, much diminished: pulse less bounding, and reduced in frequency, being only 86: the tongue still white: he complains of thirst: the bowels have not yet been relieved. No pulsation can now be felt through the compress; which, however, I did not remove, for the purpose of more minute examination; as I was unwilling to take off the pressure from the sac. He was ordered soda-water and lemon-juice, *ad libitum*.

9 P. M. The bowels have been relieved; but the skin still remains hot, and the countenance anxious: the pulse is this evening jerking and small, like that of a person who has lost a considerable quantity of blood: he expresses himself, however, as feeling, in every respect, more comfortable. He has passed a great quantity of high-coloured urine: no pulsation of the tumor to be felt through the compress.

Rep. Cal. c̄ Opio.

20th.—9 A. M. Has passed a good night; no heat of skin, and expresses himself quite free from pain: the bowels have been opened four times since the operation: countenance has still an anxious expression, and the pulse jerking: urine plentiful: some serous discharge from the wound: no pulsation of the tumor to be felt through the compress; which, from the loosening of the adhesive straps confining the compress, seems to be somewhat diminished in size. He was ordered not to take any thing but toast and water, until next visit.

12 o'clock. The countenance a little more anxious, but the pulse less jerking: skin hot. He complains of a feeling of nausea, and a

sensation of flatulence in the stomach, accompanied with a slight general depression: his bowels have been opened once since the morning. He was ordered, should the bowels be again acted upon, to take the following draught; and a small quantity of beef-tea, at intervals, if the febrile symptoms were not increased by it:—

Conf. Aromat. gr. xij. Tinct. Opii gr. viij. Mist. Camph. ʒiſs.

6 P. M. The bowels not being again acted upon, the draught was not taken. He is very restless: complains of great pain in the back, and head: skin hot: pulse irritable: tongue white, and coated. Ordered to take the saline mixture, with five drops of tincture of opium, every four or five hours.

11½ P. M. Mr. Balderson (under whose care Signor Marani was placed, as well as my own) was sent for, in consequence of a bleeding from the nose: he found the pulse bounding and labouring, which induced him immediately to withdraw twelve ounces of blood from the arm, by which the patient expressed himself directly relieved. The saline medicine, with the opium, was ordered to be continued; and he was directed to drink freely of weak warm tea.

21st.—8 A. M. He has passed a much better night, having slept, at intervals, an hour and a half at a time, during the night: had a slight perspiration: complains this morning of a painful sensation about the heart, and a strong action can be felt in all his arteries. Fourteen ounces of blood immediately abstracted: as much relief experienced as on the former occasion.

12 o'clock. He has had a considerable perspiration: tongue much cleaner: pulse 80, but rather rising: urine plentiful, high-coloured and thick: the bowels have not been opened: small doses of sulphate of magnesia were added to the saline medicine.

9 P. M. The bowels have been opened three times: the pulse soft and natural: skin moist: tongue cleaner, indicating only a slight degree of constitutional irritation: the pulsation in the tumor has entirely ceased, although every other artery in the body that can be felt is pulsating strongly: the sac is quite empty, as if no coagula had formed in it. The wound was dressed, and looked perfectly healthy, and the sutures were removed: he was ordered to take twenty-five drops of laudanum at bed-time, and to continue the same diet.

22d.—9 A. M. He has had no sleep, but says that he was perfectly free from pain, or any kind of uneasiness or restlessness: the bowels have not been opened since last visit: not nearly so much throbbing of the arteries can be felt this morning: pulse 70, rather jerking, but compressible: tongue much cleaner, and no unpleasant

taste in the mouth: skin quite natural, both as to its feel and degree of perspiration.

Rep. Mistur. salin. c̄ Tinct. Hyoa.

1½ P.M. He has taken one saline draught since the morning visit: describes himself free from all pain and restlessness: pulse jerking, but perfectly compressible: secretion of urine plentiful, but high-coloured: he has had an hour's sleep this morning.

10 P.M. Pulse less jerking, but rather more frequent; and a little increase of heat in the skin: the bowels have been once opened since last visit: has no sensation of sickness, but yet has a distaste for food: does not appear to be rendered quiescent by the hyoscyamus in his saline mixture.

Pulv. Ipecacuanhæ Comp. gr. xv. statim sumend.

23d.—9 A.M. Has passed a most excellent night; and both in voice and manner seems much refreshed: pulse 72, and perfectly regular; although yet retaining a very jerking character, without any apparent cause to explain it. The pulse of the right wrist softer and less jerking than that of the left, a difference which has been observable for the last three days: skin moist: tongue clean: no headache or thirst: has taken sago during the night, several times: has not passed any urine, nor had any evacuation from the bowels in the night, and complains of slight pain in the loins, which is immediately relieved by discharge of wind.

Ammon. Carb. gr. xvij. Mist. Camph. ℥iss. Addit. Succi Limonis recentis ℥ss. in statu effervescent. sumat ter in die.

4 P.M. Since the morning visit, has had some comfortable sleep, during which he perspired profusely: pain in the back much relieved; he is quite easy in every respect: bowels have not been opened, but the urine plentiful, and much more natural in colour: tongue clean: pulse less jerking, and 70: has had a cup of coffee, and some sago. Mr. Balderson and myself carefully examined the tumor, and not the slightest pulsation could be felt.

9 P.M. Pulse much softer, and no jerking: bowels have not been open to-day: skin natural: has not passed any urine since last report: has taken two breakfast-cups of sago.

Rep. Pulv. Ipecac. Comp.; et primo mane sumat haust. aperient.
c̄ Mag. Sulphat. ℥ijj.

24th.—12 A.M. Has passed a quiet night, with as much sleep as could be expected, considering how much he had slept the day before. Pulse softer, 70, and quite compressible: tongue quite clean: has had very little perspiration: bowels opened twice, copiously: urine

plentiful and clear. We moved him to the side of the bed, for the purpose of changing his linen; but the exertion so irritated and exhausted him, as to check our further progress. He was ordered some fish for dinner, and had taken coffee and toast for breakfast.

8 P. M. The wound was dressed; and the suppuration was considerable, but very healthy, and not the least discoloured. Still complains of pain in the back, although he has had an hour's comfortable sleep since the last visit. Bowels open: urine plentiful, but turbid when cool, although quite clear when passed. After the wound had been dressed, his pulse became quicker, and rather jerking, and he perspired freely.

Rep. Pulv. Ipecac. C. horâ somni.

25th.—9 A. M. Has had an excellent night: tongue clean: pulse 70. Gentle perspiration; and during his sleep, his breathing easy. Bowels opened once since last visit: the limb easy; and the discharge free, through the dressings. Has expressed a wish to have macaroni for dinner, which was ordered for him.

4 P. M. Has had his macaroni, and enjoyed it very much: has slept since the morning visit, during which he perspired profusely. Bowels have not been open to-day. Urine plentiful, and clear. The pulse sharp, but not quickened: but the degree of sharpness between the left and the right side particularly obvious.

10 P. M. Every thing going on well: bowels have been opened, and the pulse has lost all its sharpness; but still we can observe that the artery at the left wrist does not present its natural caliber. Perspiration rather less: no discharge from the wound. A narcotic draught ordered conditionally. Has taken no medicine to-day.

Morph. Acetat. gr. $\frac{1}{2}$. Aquæ puræ \mathfrak{z} i. p. r. n. sumend.

26th.—10 A. M. Could not sleep until two o'clock. Complained of pain in the neck, as if he had taken cold; the draught was therefore given him: soon after, he fell asleep, and immediately broke into a profuse perspiration. Bowels have not been open since last visit: urine plentiful and clear: pulse without sharpness, but rather feeble: tongue clean: pain of the back much less. To continue his macaroni, with some good soup for dinner.

Sulphat. Quinini gr. ij.

Inf. Rosarum \mathfrak{z} iss. m. ft. haust. bis die sumendus.

2 o'clock. Has had some sleep since this morning: bowels opened once, pulse natural, urine healthy: the wound was dressed, and looked remarkably healthy: the compress was removed from the aneurismal

tumor, and not the least pulsation could be discovered; but yet the sac seemed to be filled with fluid blood, which could be pressed out of it. I therefore again applied the pressure, and rather more forcibly. The limb of its natural temperature.

9 P. M. In excellent spirits: bowels have been opened once to-day: the tongue, pulse, and skin, natural. The night-draught not to be given, unless occasion required.

27th.—9 A. M. Has passed an excellent night, without an anodyne; going on remarkably well in every respect: has a good appetite for his dinner.

9 P. M. No other report to make, than that he is quickly approaching convalescence.

28th.—1 P. M. As well as yesterday. The wound dressed, and looking perfectly healthy: the sac has already become much firmer, from the application of the pressure.

29th. Has passed an excellent night: has had relief from his bowels: urine natural, tongue clean: had boiled fowl for dinner. From this period, Signor Marani continued to approach to the state of convalescence; gaining strength daily; and expressing himself infinitely better, in every respect.

To continue a daily report up to the 22d day after the operation, would only amount to the reiteration of daily improvements; but on that day the ligature was separated from the artery, and was removed from the wound with the poultice. He remained in bed two days after the separation of the ligature, by which time the wound was nearly healed: and then we allowed him to be wheeled into an adjoining room, on a sofa; which exertion, for two or three days, he sustained without any apparent inconvenience. On the fourth day he complained of some burning sensation in the cicatrix from the wound of the first operation; and, upon examination, a considerable blush of inflammation was perceptible upon the upper part of the thigh. A large poultice was applied; and, in a few hours, the whole length of the cicatrix gave way, allowing the escape of a considerable quantity of matter. The discharge, however, continued but for a few days; and upon the application of a dossil of lint, and strips of adhesive plaster, assisted by the administration of a generous diet, in less than a week the wound had again perfectly healed; and our patient was

restored to his former state of convalescence; when my professional attendance ceased. Mr. Balderson, however, still continued to visit him occasionally: and I have twice since seen him, in consultation with Mr. Balderson, in consequence of an inordinate action in his heart and arteries, from the slightest mental excitement; and which, in one instance, had been induced to an alarming extent, from his receiving the news of the death of his father. Upon this occasion, Sir Astley Cooper visited Signor Marani, with us: he gave it as his opinion, that there was no aneurism—which we had rather feared to have existed in the abdominal aorta—but that the inordinate action depended upon his natural irritability of constitution. Sir Astley Cooper prescribed the muriated tincture of iron: which he had taken but a few days, when his arterial system became calm, and his general health so to improve, as to enable him to leave London for the sea-side. In a fortnight, he returned to town, perfectly well; and has now left England for Milan, his native place.

It is very difficult to understand what could have caused the failure of the first operation: for there can be no doubt, from the description given by Mr. Greeves, as well as from the immediate effects produced by his operation, that the ligature was applied upon an artery; but perhaps, from a high division of the femoral into two trunks, one only, and that probably the smaller, might have been included. I am inclined to believe that such a variety was the cause of the difficulties which occurred, and of the pulsation which could be felt in the course of the cicatrix of the incision made by Mr. Greeves: for had the failure of the obliteration of the sac depended upon the enlargement of the usual anastomosing vessels, the pulsation of the tumor could not have returned so quickly as it did after the operation; for time would have been required for their gradual enlargement: and, moreover, the vessel felt in the fore-part of the thigh could not be an enlarged anastomosing branch, as they are all sent off from the profunda, excepting the anastomoticus magnus, which is given off far below the point in

question. It might perhaps occur, that some of the perforating branches of the profunda, by the free anastomoses with the anastomotic branch, and internal articular of the popliteal artery, kept up the supply of blood to the sac: but in that case, also, it would be difficult to understand, in the event of a natural distribution of vessels, how the pulsation of the sac should have so quickly returned. Sir Astley Cooper had a case somewhat similar to this, in which he had tied the femoral artery in the usual situation for popliteal aneurism. Nothing particular occurred, and the ligature separated at the usual period: a few days after which, the sac inflamed, suppurated, and an abscess formed, and ultimately burst; when hæmorrhage occurred repeatedly, and finally destroyed life. Upon dissection of this limb, it was found that a large branch had been given off from the femoral, above where the ligature had been applied; had again united with the femoral, just as it becomes popliteal; and had thus prevented the obliteration of the aneurismal sac. Such a distribution might indeed have existed in the case of Signor Marani: but if so, at any rate a further variety presented itself in the course of the popliteal artery, in its passage through the adductor magnus; or else Mr. Greeve's operation may have obliterated that trunk; and the vessel which I tied may have been the one of unnatural distribution. But then, again, remains the inexplicable fact of the application of my ligature not immediately stopping the pulsation. It should, however, be remembered, that the result of Mr. Greeve's operation would be, to enlarge all the anastomosing branches; which for a time, therefore, until obliterated by the inflammation of the second operation, conveyed the blood to the sac.

The following unnatural division of the femoral artery would give a probable solution of the mystery which involves this difficult case. If a considerable unusual branch had been given off by one of the perforating vessels of the profunda artery, and had taken its course at the back part of the thigh, so as to enter the popliteal artery in the ham, immediately above the sac, it would necessarily occur, that the application of a ligature upon the femoral artery, below where the profunda is given off, would not prevent the flow

of blood into the aneurismal tumor; and that, therefore, the second operation became necessary. Such a distribution, accompanied also by the obliteration of the femoral in consequence of the operation of Mr. Greeves, sufficiently accounts for the circumstance of my not meeting with the artery in the usual situation of perforating the triceps muscle; while the pulsation in the cicatrix of the original wound might have occurred, either from the enlargement of some muscular branch, or from a high division of the anastomoticus magnus. This explanation will also accord with the fact, that the deeper dissection into the popliteal space, during my operation, led me to the main trunk supplying the aneurismal sac; while the pulsation, which returned for a time, shews that the ligature was placed above, and so near the abnormal communicating artery, as to lead ultimately to its obliteration: then, and not till then, the pulsation in the tumor ceased, and a cure of the disease was effected.

The accompanying diagram is intended to represent such a distribution of arteries; and will, perhaps, serve to make the description more easily understood.

- a* The femoral artery. *b* The profunda. *c* The obliterated femoral.
d The popliteal.
e The supposed abnormal artery communicating with the popliteal.
f Aneurismal sac. *g* Enlarged muscular branch.



From the beneficial effects of pressure upon the sac in this case, I am inclined to believe that the mechanical and medical treatment of aneurism without operation has scarcely been sufficiently tried by surgeons; and that pressure upon the sac, as well as upon the trunk leading to it—at the same time a perfect state of rest being strictly maintained, and the action of the heart and arteries being by medical means diminished—might often lead to such a deposition of fibrine in the sac as would produce a cure;—an occurrence which does not unfrequently take place, by the spontaneous efforts of nature.

CASES OF HERNIA.

CASE 1.

SARAH SHANKS, aged 50, a strong muscular healthy woman, and the mother of eleven children, was admitted into Esther Ward, on the 20th of June 1837, under the care of Mr. Bransby Cooper; being the subject of a strangulated femoral hernia on the left side. She describes, that she had had a femoral hernia on the right side for seventeen years; and that on the evening of yesterday, the 19th, whilst walking, she suddenly felt a "giving way" in her left groin, where she perceived a tumor: this was succeeded by vomiting, and a sensation of tightness and pain across the scrobiculus cordis. She immediately consulted a medical gentleman; by whom she was bled, and placed in a warm bath; in which the taxis was applied, but without success: a tobacco enema was then administered, which produced a powerful effect upon her system; but still, in this condition, a further attempt at the reduction of the hernia proved unsuccessful: she was therefore brought to the hospital.

Upon her admission, her symptoms were far from urgent: she had slight sensation of nausea, but no vomiting: some degree of dragging pain across the scrobiculus cordis: pulse 88, and countenance but slightly expressive of anxiety: tongue clean: bowels constipated. Upon examination, a femoral hernia was found on the left side, about the size of half an orange; but neither tense, nor tender to the feel; nor was it susceptible of any dilatation upon coughing. The taxis was employed for fifteen minutes; during which a gurgling sensation was communicated to the touch, when immediately the tumor appeared to be lessened in size, a portion of its contents, however, remaining in the sac; so that the taxis was still employed, but without further success. A purgative enema was given; which remained about twenty minutes, when a part of it only returned. A second injection was thrown up an hour after; but which shortly came away, without any feculent matter. A third was then given, without, however, producing any motion. Her symptoms remained mild until 7 o'clock in the morning of the 21st, when she began to be sick, and vomited a quantity of thick

green fluid: the pain across the epigastrium increased, the countenance had become more anxious, and the tumor had resumed its former size, being now more tender to the touch: she had no hiccough: the tongue still clean; and the pulse 84, and compressible. Ice was now applied to the tumor; and Mr. Cooper was sent for, who saw her about 1 o'clock P. M. He made a further attempt to reduce the hernia; and succeeded in returning into the abdomen a portion of the contents of the sac, apparently what had been returned on the previous evening: but as a tumor still existed, and the patient derived no relief from the urgency of her symptoms, an operation was immediately proposed, and her consent obtained.

OPERATION.

A crucial incision was made upon the tumor, through the skin, and the flaps dissected back: the fascia transversalis was then divided, and dissected back in a similar manner: an incision was next carefully made into the fascia propria or sheath of the femoral vessels, and the hernial sac exposed. A director was then introduced between the fascia propria and hernial sac, and an attempt made to insinuate it through the stricture; which was so firm, however, as to offer considerable resistance, and lead to the only difficulty in the operation; which was overcome by bending the director to an appropriate angle, when it passed into the abdomen; and the hernial knife being directed along it, the stricture was divided; when immediately the hernial sac became flaccid. Mr. Cooper then, with the slightest manipulation, returned the contents of the sac into the abdomen, without opening the peritoneum: the wound was dressed, and the patient put to bed.

Half-past 2 P. M. Vomiting, and even nausea, have entirely subsided: no dragging sensation in the epigastrium. She complains of a slight griping pain across the lower part of the abdomen; but has no tenderness on pressure: pulse 82, and rather feeble: skin warm and moist.

Mag. Sulph. ʒij. Aq. Menth. Pip. ʒiſs. statim sumend. et repetend. quaque secundâ horâ donec alv. respond.

9 P. M. Has had one copious feculent stool, and describes herself in every respect as comfortable.

22. Has passed an excellent night: no sickness, nor tenderness about the abdomen: tongue clean: pulse 86, and soft: bowels have been four times freely opened, the motions consisting of dark foetid fluid.

Omitt. Medicamenta.

3 P. M. Has passed three stools since last report, and of greater consistency, although still foetid: makes no complaint, except of slight smarting of the wound.

23. Has had a very good night: pulse 86: skin moist: slight inflammatory blush round the wound: complains of considerable prostration of power, which she attributes to an excess of catamenia at this period. Fomentations were ordered to the wound.

24. Inflammation round the wound extending: tongue clean: pulse 80: bowels not open since last report: wound looking rather sloughy: the sutures were removed, cold white-wash poultice was applied to the part, and the following medicine ordered:

Hyd. submur. gr. iſs. Pulv. Jacob. Ver. gr. iij. Pulv. Opii gr. ſs.
m. ft. pil. statim sumend.

Ammon. Carb. gr. viij. Tinc. Hyosc. m. xij. Mist. Camph. ʒiſs.
m. ft. haust. Adde Succi Limonis recent. ʒſs. in statu efferv.
sumend. ter in die.

25. Inflammation about the wound subsiding; but the wound itself still sloughy. A bread-poultice ordered to the wound, and white-wash to be applied to the surrounding inflammation: the bowels not having been opened for two days, a senna-draught was ordered.

26. Much improvement in every respect: bowels well opened, and the wound looking healthy. From this period no untoward symptom occurred, although her progress towards convalescence was slow. Generous diet, with porter, were allowed her; and she remained in the hospital until the end of July, free from any complaint excepting debility; when she became sufficiently well to leave the hospital, to seek benefit from change of air, which soon restored her to perfect health. She was furnished with a double truss before her dismissal.

CASE 2.

WILLIAM DICKS, aged 67, a weather-beaten looking man, was admitted into Job's Ward, May 3, 1837, under Mr. Bransby Cooper, being the subject of strangulated hernia.

He stated, that on Friday last, the 28th of April, whilst dressing a horse, he experienced the sensation of a sudden strain at the lower part of his abdomen, which was imme-

diately succeeded by a feeling of nausea. He then felt that remarkable dragging pain so characteristic of strangulated hernia, across the scrobiculus cordis, which was followed by the vomiting of a quantity of yellow fluid. His bowels were constipated, and the symptoms became gradually more urgent. Some aperient medicine was administered, which the stomach immediately rejected.

May 3. At this period he applied for admission into Guy's Hospital, when he was labouring under the following symptoms:—His countenance rather anxious: lips particularly livid: almost constant hiccough: a dragging sensation across the epigastrium: sickness, and an incapability of retaining any thing on the stomach: bowels obstinately constipated: abdomen soft: very slight tenderness over the pubes: a cold sweat confined to the face: pulse 88, jerking, but without power. A large femoral hernia was found in the left groin, which was rather hard, and tender to the touch. There was no dilatation on coughing. The tumor was of sufficient size to turn very considerably over Poupart's ligament. The taxis was employed unsuccessfully; and in consequence of the intestine having been strangulated for five days, no further attempt at reduction was made, but the operation immediately resorted to.

1 o'clock. OPERATION.—Mr. Cooper made a transverse incision across the base of the tumor; and another vertical one, commencing from the centre of the first; so that the two incisions were in the form of an inverted T. Having thus divided the skin, the superficial fascia was next cut through, and the fascia propria exposed. A small opening being made in it, a director was passed in upon the sac, and the fascia divided up to the neck of the hernia, where the stricture was found very firm: the director was then passed through the stricture, and, by a probe-pointed bistoury, the constriction was liberated, and attempts made to return the contents of the hernial sac, without opening its cavity. This, however, proved impracticable, although the attempt was continued a considerable time. The sac was therefore laid open; which was found to contain a considerable quantity of omentum, adherent to the upper part of the sac. Upon turning the omentum out of the sac, the

lower portion of it was found altered in structure. Mr. Cooper, therefore, removed the lower half; which was not followed by any hæmorrhage, its vessels being filled with coagulated blood. Upon further examination as to the contents of the sac, a small knuckle of intestine was found behind the remaining portion of omentum; which, upon being touched, immediately receded into the abdomen; a large portion of omentum being still left in the sac. The wound was dressed, and the patient put to bed.

Half-past 2 P. M. He still complains of slight nausea, but has no return of vomiting or hiccup: pulse 84, rather full, but compressible: has perspired freely: face flushed: tongue slightly furred: bowels not open.

Mag. Sulph. ʒij. Aq. Menth. Pip. ʒi. m. ft. haust. statim sumend. Mag. Sulph. ʒi. secund. quæque hor. repetend.

9 P. M. His bowels have been relieved three times, and he expresses himself as being comfortable: no return of sickness or hiccup.

May 4.—10 A. M. Has passed a good night, although the nausea and hiccup have returned in a slight degree: bowels opened once; skin moist: pulse 80, jerky and irregular.

Julep. Ammon. Acet. ʒxiss. Spt. Ætheris Nit. ʒss. m. sumat coch. maj. ij. quartis horis.

2 P. M. Bowels have not been relieved to-day: tongue furred: pulse 80, intermitting. A castor-oil injection to be administered.

5. His bowels have been freely opened: pulse 80, not so intermitting as yesterday: no return of the sickness or hiccup: complains of a griping pain in his bowels: tongue red and dry: wound looks well: no tenderness of the abdomen.

Sod. Carb. ʒi. Tinct. Cardam. comp. ʒss. Liq. Op. sed. gtt. xv. Aquæ ʒx. m. ft. haust. sextis horis sumend.

5. His mind has been wandering during the night: slept indifferently: complains of giddiness, and slight defect in his vision: pupil rather contracted, but acting on the application of light: no sickness or hiccup: bowels have not been relieved since last report: tongue dry, and furred: no pain in his abdomen: pulse jerking and irregular.

Ammon. Carb. gr. iij. Sod. Subcarb. gr. viij. Tinct. Hyosc. gtt. viij. Tinct. Card. C. ʒss. Aquæ ʒiss. ft. haust. bis in die sumend.

May 7. His sleep has been disturbed, in consequence of a gripping pain in his bowels, from taking some milk in his arrow-root: his bowels have been opened three times: tongue moist, much cleaner: pulse 84, intermitting irregularly: no sickness or hiccough: no tenderness in his abdomen: slight inflammation around the wound. Mr. Cooper saw the patient to-day, and removed the sutures and the protruding portion of omentum.—Pergat.

8. He has passed a restless night: complains of lightness in his head, and giddiness: tongue cleaner: bowels open: pulse 78, feeble: no sickness or hiccough: copious discharge from the wound: no tenderness of the abdomen.—Pergat.

9. Countenance cheerful: in every respect improved. He had a mutton-chop yesterday, which he enjoyed. Bowels not open: tongue cleaner.

10. In every respect improved.—Pergat. Three ounces of wine daily.

11. In consequence of his bowels not having been relieved, he was ordered $\mathfrak{z}\text{ss}$. of castor-oil. From the present date, he continued to improve, until the 26th; by which time he was convalescent, and the wound entirely closed.

OBSERVATIONS.

The apparently urgent symptoms under which this patient laboured a few days after the operation did not create much alarm in my mind, as his bowels were acting freely, and as such symptoms are frequently concomitant with sloughing of omentum in a hernial sac; and a favourable termination was all along anticipated. This case is important, in demonstrating the fact, that the attempt to return the contents of a hernia without opening the sac does not in any way interfere with the prosecuting the operation in the usual manner. And I do most completely agree with my colleague, Mr. Key, in recommending that the attempt should invariably be made: for in five cases in which I have successfully operated, my patients have suffered no more after the operation than they usually do after the successful application of the taxis; while, on the contrary, when the hernial sac is opened, and the peritoneal cavity necessarily exposed, a high degree of constitutional derangement, and subsequent prostration of power, almost always follows. If the attention be directed to this, and the preceding Case of Sarah Shanks, it may be observed, that

the relief which she obtained was immediate; and that no decided impression seemed to be made upon her system, as followed in the case of William Dicks, in whom the sac had been opened.

CASE OF UNUNITED FRACTURE OF THE HUMERUS.

Reported by Mr. JOSEPH WILLIAMS.

ELIZA GOOD, aged 28, a young woman of a very healthy appearance and ruddy complexion, was admitted into Mary's Ward, under Mr. Cooper, on the 9th of March 1836, with an ununited fracture of the left humerus; the solution of continuity having taken place just below the insertion of the deltoid muscle. She states, that six months ago, while in perfect health, she was thrown from a cart; and upon rising from the ground, she found that she had lost the use of the arm. She immediately applied for professional advice; and, from her own account, appears to have been most judiciously and properly treated. But in about eight weeks after the splints had been applied, and the usual means adopted, the surgeon discovered that no union had taken place: he therefore replaced the splints more firmly than before, and bound the arm to the side, in order to prevent any degree of motion. The apparatus was worn for a month, without being removed; and notwithstanding her strict adherence to every instruction given her by the surgeon as to the maintenance of perfect rest, it was then found that no progress had been made towards ossific union. The surgeon therefore replaced the apparatus, with the addition of an iron splint, extending from the outer side of the humerus to the wrist, being bent at an acute angle: and the arm was, as before, bound to the side.

This plan was also persisted in for a month, but with no better effect. The surgeon, still unwilling to give up the case in despair, made one other attempt, by applying a bandage tightly round the arm; and, placing wooden splints over it, compressed them to the utmost the patient could bear, to which she submitted patiently for two months; at the expiration of which period, the fractured extremities of the bone were found as moveable as ever. On the 9th of

March, 1836, she was admitted into Guy's Hospital; when, upon examination, Mr. Cooper discovered the two fractured extremities of the humerus to be in juxta-position, but without union, or any adventitious formation in the surrounding structures, preparatory to it. The two portions of bone moved readily upon each other, but without producing any thing approaching to the sensation of crepitus: on the contrary, the mobility of the part conveyed the impression of the formation of a supernumerary joint, and the muscles were capable of producing some voluntary motion. Mr. Cooper mentioned, that he believed that the mechanical means which had been adopted had been judiciously employed; and at once abandoned the hopes of producing union by the usual means adopted in cases of simple fracture. He proposed, therefore, to the patient, to submit to a seton being passed through the supernumerary joint: to which she readily consented, and the operation was performed on the 23d of March;—having attempted however, for ten days prior to the operation, the effect of forcibly rubbing the extremities of the fractured bone against each other, but without avail. There was scarcely any bleeding produced by the operation; nor, for the first two days, did she either complain of pain, or suffer from any constitutional irritation. On the third day, 25th of March, she complained of a feeling of a flushing in the face, attended with thirst and other signs of irritative fever; for which she was ordered,

Hyd. Submur. gr. iſs. Pulv. Opii gr. $\frac{1}{2}$. m. ft. pil. statim sumend.

Mag. Sulph. \mathfrak{z} ſs. Liq. Ammon. Acet. \mathfrak{z} iſs. Liq. Ant. Tart. \mathfrak{z} iſs. Tinct. Hyosc. \mathfrak{z} ii. Aquæ Distil. \mathfrak{z} viſs. m. capt. coch. maj. ij. quâque quartâ horâ, donec alvus bene responderit.

28th. The paste-board splints, which had been applied immediately after the seton had been passed, were removed, for the purpose of examining the state of the arm; when it was found that some callus was thrown out; and shooting-pains, of which she complained along the humerus, especially at night, indicated the presence of inflammation in the bone: the paste-board splints, therefore, were resumed. The seton was worn ten weeks; but the irritation, which for the

first few days held out a prospect of success, soon subsided; and proved, ultimately, to have led to no happier result than that of the former attempts; although it was observed that there was rather less motion between the two bones than there was prior to the seton. A bandage was dipped in a composition of egg and flour, and firmly bound around the arm, the application of which preserved, in the most perfect manner, an immoveable condition of the limb: this was worn for six weeks, being so applied as to enclose the elbow and shoulder, and forcibly to press the two extremities of the bone against each other, but still without the desired effect. As a last resource, Mr. Cooper ordered, on the 12th of June, the whole limb to be enveloped in plaster of Paris, and the patient to maintain the recumbent posture.

Sept. 18. She complained of considerable pain and uneasiness, which prevented her from sleeping. A night-draught, containing twenty drops of opium, was ordered; and some febrile symptoms followed, requiring medical treatment. But as Mr. Cooper supposed, from the feelings which she expressed, that some new action was set up in the part, he was anxious not to remove the plaster; but allowed it to remain on the arm until the 12th of July, when it was chiselled off; and much disappointment was felt at finding the arm precisely in its former condition.

About this period, Mr. Collis, from Dublin, paid a visit to Guy's Hospital; and, in going round the wards, Mr. Cooper drew his attention to the case in question. He said he had seen the administration of mercury, continued until it produced ptyalism, lead to the consolidation of ununited fractures, after all other means had failed; and quoted two cases in illustration of the assertion. The patient was accordingly immediately ordered four grains of Hyd. \bar{c} Cret. three times a-day; and a well-padded leathern girth, furnished with straps and buckles, was firmly applied immediately over the seat of fracture. In four days, ptyalism was produced, and the quantity of mercury was diminished. On the sixth day the powders were suspended, as she suffered severely from their effects. The leathern girth was worn a month; and upon its removal, perfect union of the bone had taken place; affording satisfactory proof that the mercury had produced

an altered action on the capillaries of the affected part, and exemplifying the powerful alterative influence of that metal. She remained in the Hospital six weeks after this happy result, to regain her strength: when she was discharged as cured, and with a perfect use of her arm.

Three months after her departure, she was again admitted into Guy's Hospital, for a fracture of the same arm, produced by a violent blow, inflicted by a man running with great velocity against her, and knocking her down. Upon examination, it was found that the humerus was fractured rather below the seat of the former injury: all the usual concomitant symptoms of simple fracture were present, as crepitus, &c.; and by the application of the same girth which had been employed on the former occasion, the bone united at the usual period, without the exhibition of mercury.

OBSERVATIONS.

There are various circumstances which may contribute to interfere with, if not entirely to prevent, the reparation of a fractured bone; and these may be classed under the three following heads:—1st, Some peculiarity in the constitution or condition of the patient: 2dly, Circumstances concomitant with the fracture: and, 3dly, The want of due attention to the co-aptation of the fractured portions of bone, and to the maintenance of their perfect rest. The state of the constitution has considerable influence in modifying the process by which bones are united. In some, it would appear that there was a deficiency in the capillaries of the osseous system; for while such patients seem capable of performing every other function properly and duly, yet the reparation of bone may be excessively difficult to be produced, as if phosphate of lime was with great difficulty eliminated from the blood. Large ulcers, malignant diseases, necroses, scrofulous diatheses, and even pregnancy, are all causes known to retard the union of fracture; and it is by constitutional means, as well as the usual mechanical applications to the fractured bone, that, in such cases, a union may be produced. Under the second head, various local circumstances may lead to the same difficulty; as, for instance,

the great obliquity of the fracture may cause the penetration of one of the portions of bone through a muscle, which may prevent the possibility of a co-aptation. The extravasation of blood may also form a coagulum between the two bones. The tearing through of the principal artery of the limb may remove from the injured bone its source of nourishment. The laceration of soft parts may so insulate the fracture, as to deprive it of that assistance from the surrounding structures essential to the deposition of callus. Dislocation concomitant with fracture may also offer great difficulty; and for each or all of these casualties, no general principle can be adopted, to obviate them: but the surgeon must be guided in his practice by a due consideration of the age, sex, and constitutional powers of his patient, before he can decide upon the most judicious treatment, or judge whether or not the limb is to be sacrificed.

When a fracture remains disunited, from the broken ends of the bone not being placed in juxta-position, or from the limb having been permitted to be moved, it is evidently the fault of the surgeon; for perfect co-aptation and rest are self-evidently indicated in every fracture; and motion, although it sets up an action in the vessels of the injured bone, induces rather the formation of a supernumerary joint, than consolidation of the two portions. Besides the close adaptation of the two ends of a broken bone, perpendicular pressure should be made upon them, where there appears a difficulty in their consolidation; for the support of weight is the natural function of the osseous system. This principle, at first sight, may appear only applicable to the bones of the lower extremities; but it is to be remembered, that those of the upper extremity also receive great pressure, in the direction of their long axis, from the action of their powerful muscles. This theory may be frequently seen confirmed in practice, by observing the rapid and firm consolidation which takes place after the subject of a fractured bone is allowed to remove from the recumbent posture, and in some measure to use the injured limb.

The Case in question seems to come under the first class of causes which prevents the union of bone: for from the history it appears, that there were no circumstances con-

comitant with the fracture which retarded union; nor did it appear that there was any want of attention, on the part of the surgeon, in the employment of all the usual means applicable to the case: therefore, to the constitution only can any cause be assigned for the delay of her cure; and yet, by the most minute examination, the defect could not be ascertained. It may perhaps, in some measure, be attributable to the fracture having occurred just through that portion of the humerus which is covered by the tendinous expansion of the insertions of the deltoid and coraco-brachialis muscles; at which point, also, the triceps and biceps being lined by fascia, the humerus is but little covered by such structures as would tend to assist in ossific deposition; and it is under such circumstances that we find fractures most frequently converted into supernumerary articulations.

CASE OF WOUND OF THE TONGUE.

WILLIAM HARRIS, aged 20, a strong and vigorous young man, was admitted into Guy's Hospital, under Mr. B. Cooper, on the 4th of September. He stated, that, three days before, he was smoking with a fellow-workman, when, by accident, the elbow of his companion came in contact with the bowl of his pipe with great force, and drove its narrow extremity into his tongue, breaking off about three inches of the pipe: he immediately sat down upon some steps, suffering excruciating pain, and fainted away. At the time of admission, a wound was perceptible, passing obliquely through the tongue, from the right to the left side. There was no hæmorrhage from the wound; but the tongue and fauces were much swollen. At this period he did not complain of much pain, but deglutition and speech were impeded. A swelling of considerable size existed, just behind the angle on the left side of the jaw. A surgeon had examined the wound, immediately after the accident, who could not discover that any portion of the pipe remained in the tongue; and this was also the patient's opinion. Leeches were applied to the swelling, and a cathartic draught prescribed. The following day he seemed much relieved; and already

the wound in the tongue had closed. On the 5th, the tongue could be drawn into the mouth; and his speech and deglutition were much freer.

Sept. 6. He discharged from the nose and mouth about a pound of blood; which was a dark coagulum, and appeared to be thrown off from the stomach. He seemed much reduced by this loss of blood, which recurred on the 8th and 10th of September. On the 12th, he had become excessively reduced; and might be said to be in a perfect state of anæmia. No wound could be discovered in the tongue, or any where in the mouth, to point out from whence the hæmorrhage proceeded. There was, however, so much swelling about the tongue and fauces, and the jaw could be but so imperfectly depressed, that only a very unsatisfactory examination could be made of the parts, and the source of the bleeding still remained in obscurity; nor was there any evidence of the presence of a foreign body in the inflamed parts.

Plumb. Acetat. gr. $\frac{1}{2}$. Pulv. Opii gr. $\frac{1}{2}$. m. ft. pil. quâque quartâ horâ sumend.

Acid. Sulph. dil. gtt. xv. Inf. Rosar. ʒiſs. m. ft. haust. ter die sumend.

14. He appeared to be sinking fast; and ejected a considerable coagulum from his stomach during the visit; which reduced him to so low a state, that transfusion was contemplated, but relinquished in consequence of the patient's rallying in the afternoon. Two grains of the sulphate of quinine were now ordered to be added to the infusion of roses and acid, and an alum gargle directed to be employed.

15. He died at seven P. M., almost immediately after a discharge of blood from the mouth, which was still brought up as a coagulum from the stomach; although there never was any bleeding into the mouth, as if from thence the blood issued.

The body was examined the next day, at one o'clock; and the following appearances presented themselves.

The surface of the body was quite exsanguine, but yet not emaciated. On injecting the carotid arteries with fine injection, the coloured fluid flowed copiously from both nos-

trils, particularly from the left. A small irregular opening was discovered, just behind and below the left tonsil, appearing as if produced by the penetration of a piece of tobacco-pipe; and there was also discovered a cicatrix on each side of the tongue, marking the situation of the former wounds. A portion of the extreme end of the pipe, two inches and a half in length, was found imbedded within the substance of the tongue. The extraneous body could not possibly be seen, or even felt from within the mouth. The external carotid and all its branches, and the internal for more than an inch from its origin, were perfect: even the lingual artery had escaped injury. There was a small coagulum, mixed with mucus, in the stomach: and a firm dark clot of blood was found, extending the whole length of the respiratory tube, filling even the smallest divisions of the bronchi, although no traces could be discovered from whence the blood issued. The lungs were in a remarkable state of emphysema. A preparation of the parts, *in situ*, is preserved in our Museum.

It is impossible to read the history of this case without regretting that the carotid artery had not been tied; and repeated examinations were made for the purpose of ascertaining whether or not the lingual artery had been injured: but as no hæmorrhage had occurred upon the infliction of the wound; as no subsequent bleeding could be discovered from any part of the mouth; and as, upon the strictest investigation, there was no means of discovering that any foreign body still remained, either in the tongue or fauces, the bleeding was rather attributed to a constitutional hæmorrhagic tendency, than to the positive result of local injury; so that Mr. Cooper was deterred from performing an operation, which might have proved successful; although the post-mortem examination did not elucidate the source from which the bleeding proceeded. The manner, also, in which the blood was ejected from the stomach seemed more like common hæmatemesis, than the bleeding from a wounded artery.

CASE OF STONE IN THE BLADDER.

Reported by Mr. W. COOKE.

GEORGE WRIGHT, aged seven years, was admitted into Luke's Ward, June 5, 1837, a boy of delicate complexion, with dark hair and eyes, and slender in his person: his parents were never afflicted with calculous disorders. He has laboured under symptoms of stone for the last six years. The disease was first detected by the difficulty he experienced in voiding his urine, and the too frequent calls for the purpose. The prepuce has become elongated, by being constantly drawn out by the patient; who seems relieved by so doing, from the irritation caused by the flow of urine through the urethra. The symptoms of calculus have been very mild until within a very few weeks; when they manifested themselves in a more aggravated form, interfering with his playful exercises; and he could not jump from any height without suffering pain: at that time his urine was never retained for more than three hours at a time. His urine is now natural in appearance, and has never been tinged with blood. Mr. Cooper has sounded him, and pronounces the calculus to be rather a large one.

June 20th. The operation (which lasted 'forty' seconds) was performed by Mr. Cooper this morning. The stone was rather large, and covered with crystals.—In the evening, some urine passed by the natural passage, producing a smarting pain: the patient is rather restless.

Sumat Syr. Papav. ʒi. statim.

21. Passed a comfortable night: skin moist: water passes through the wound: countenance cheerful: pulse natural.

22. Feels pain over the trochanter major; increased on moving the joint: bowels not open: tongue furred: skin hot: water passes freely through the wound. Ordered hot fomentations to the hip.

Hydrargyri Chloridi gr. ij. Pulv. Scamm. gr. ij. Pulv. Jalapæ gr. iv. m. ft. pulv. statim sumendus.

23. Feels pain over the region of the colon, which is increased on pressure: pulse 100: bowels not open: skin and tongue as yesterday: a draught, containing carbonate and sulphate of magnesia, was administered this morning: at 3 P.M. an enema was thrown up, two hours after which the bowels were plentifully relieved.

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24. Has passed a good night: skin cool: pulse 102: tenderness of the abdomen much diminished: tongue clean: has taken ten grains of the rhubarb and calomel powder this morning, which has opened his bowels freely.

25—28. Convalescing rapidly: water passing through the wound.

29. Urine has commenced flowing through the natural passage.

30. Wound is closing gradually; and the quantity of urine passing through the natural passage is daily increasing.

From the 30th he has been rapidly convalescing, no untoward symptom presenting itself; and has to-day (twenty days after the operation) been presented, perfectly cured.

EXAMINATION OF THE CALCULUS,

By Dr. G. O. REES.

The surface of the calculus is thickly studded with bright transparent crystals, which are deposited on a dense semi-crystalline layer of calculous matter.

Nitric acid, diluted with an equal bulk of water, dissolves these crystals with but little difficulty; yielding no evidence of lithic acid on drying the solution and moistening the result with a solution of ammonia.

Hydrochloric acid dissolves the crystals; the solution yielding no evidence of the existence of earthy phosphates.

Heated on platinum foil, the crystals become charred; and decarbonization being complete, a white ash remains; which effervesces while dissolving in weak hydrochloric acid, and is precipitable from the solution by the addition of oxalate of ammonia: no alkali is discoverable; nor any earth, except lime.

We thus prove the existence of an organic acid in the crystals; which is combined with lime, and yields the carbonate of that base on being heated to redness. It having been proved that lithic acid did not exist in these crystals, and the only other organic acid which is detected in urinary concretions being the oxalic, I could not but conclude that, in all probability, oxalate of lime had assumed its crystalline form on the surface of this calculus; and, on continuing my examination, this curious fact was placed beyond a doubt. The acid was procured in combination with the oxide of

silver, by precipitation of the nitrate of that base: the precipitate was white, deflagrated on the application of heat, and underwent all the re-actions of oxalate of silver. The solution of sulphate of lime is precipitated by the acid procured from these crystals, when digested in a weak solution of potash which has been allowed to become partially carbonated. The precaution of neutralizing the liquor is necessary in this experiment.

The semi-crystalline layer, on which the crystals are deposited, is composed of oxalate of lime, with a minute proportion of phosphate of lime.

The third layer from the surface consists of carbonate and phosphate of lime, with lithic acid.

It being impossible to saw this calculus without destroying the crystals, the nucleus and deep layers are not examined. The dimensions of the calculus are as follows:—length 1 inch; thickness $\frac{9}{16}$ inch; breadth $\frac{1}{8}$.

I am indebted to the great kindness of Mr. H. J. Brooke, for the following communication on the form of these crystals.

“I have taken off two or three crystals, but have not found them measurable by the goniometer. The figure is an octohedron, with a rectangular base: but whether the sides of the rectangle are equal, so as to give a square prism as their fundamental form, can only be determined from the measurement of a on a , and b on b ; for which brighter crystals are required.”



ON
THE DIAGNOSIS
 OF
ORGANIC DISEASES OF THE UTERUS.
 BY DR. ASHWELL.

I AM induced, by the frequency and importance of these diseases, to offer some remarks on their diagnosis. And I claim indulgence for such an attempt, not only because the distinction itself is, in many instances, difficult, but because this Paper does not assume any higher character than an endeavour to render more easy the study of so complicated a portion of pathology. If proof of this difficulty were needed, I might point to the perplexities of the diagnosis where organic diseases of the uterus co-exist with pregnancy; and where, embarrassing as is the distinction, the safety of the patient mainly depends on its accuracy. I know, practically, that it is sometimes almost impossible, with every aid, to arrive at certainty respecting diseases of the womb; but I also know, that they are often overlooked or misunderstood, from the want of a sufficiently early and careful investigation. Nor is this delay to be altogether ascribed to the physician or surgeon: there is, amongst delicate females, a natural repugnance to the early and necessary examination; and the concealed situation of the uterus, within the pelvic cavity, renders the task, however ably performed, by no means a simple one. I hope, notwithstanding these difficulties, to point out the methods by which the student and inexperienced practitioner may advantageously inquire into the nature and precise seat of these dangerous maladies.

It is scarcely necessary to remark, that to do so successfully, they must, as preliminary, understand the healthy condition and the healthy varieties of the female generative organs. It will be in vain that they attempt to appreciate morbid deviations, if this previous knowledge be not possessed. The

reader must therefore, in some sections of this Essay, excuse descriptions of the anatomy of the parts, and of the normal varieties of structure occasionally met with: nor must he expect much that is new;—my aim being classification, not discovery.

There are several methods of inquiry; but they are not all equally efficient. From two sources, important facts may always be obtained; and from two instrumental methods of examination, and from the discharges, auxiliary and confirmatory knowledge may often be elicited.

THE HISTORY OF THE SYMPTOMS, and

THE EXAMINATION BY TOUCH,

afford, in every instance of organic uterine disease, certain and indispensable information: whilst

THE SPECULUM,

THE STETHOSCOPE, and

THE DISCHARGES,

will often assist, and may occasionally lead to an incontrovertible opinion.

THE HISTORY OF THE SYMPTOMS.

It is hardly requisite, in a practical communication, to enter minutely into all the particulars of a suspected case of organic disease: and yet, without the facts with which the previous history alone can furnish us we shall often remain ignorant of the morbid actions of the general system. I forbear more than an allusion to the influence of temperament, or diathesis*. A strumous habit is frequently associated with organic glandular disease; while a high standard of mind, and exquisite nervous sensibility, apart from struma, are more commonly connected with hysteria, and the perplexing varieties of irritation, than with structural change. None of us can forget how often, where pain has indicated inflammation, the remedy which procured relief clearly proved that irritation was its cause. Nothing can excuse a disregard of symptoms, supposed to depend on organic change. Each case must be a distinct object of inquiry;

* It is perhaps worthy of notice, that in thirty-three cases of Carcinoma Uteri, occurring amongst my out-patients at Guy's, twenty-three of the women were of dark complexion.

and every symptom deserves to be pathologically traced to its true origin. I may illustrate the necessity of such a procedure, by a case which has often occurred to me. A patient complains of difficulty and shortness of breathing, pain in the hypogastric region, and general abdominal enlargement. If she has attained fifty years of age, if there be a tolerably distinct increase of bulk in the site of the uterus, and if there be obstructed action of the large intestine and urinary bladder, a hasty and imperfect inquiry might determine that uterine, or other tumor of a structural kind, was the cause of these sufferings. An unfavourable prognosis would probably be pronounced, and a merely palliative treatment would be adopted. Let the history of these symptoms be carefully inquired into, and it is far from improbable that the indications, throughout the whole course of the case, may not have pointed to organic change. There may have been constant indigestion, torpor of bowels, and general inactivity of system. The result is seen in acute and spasmodic pain; in frequent flatulent distention of the bowels; in a hard enlargement of the lower belly; and in a general and unhealthy deposition of adipose matter over the whole of the abdomen;—still, without structural disease.

But it is necessary to be more precise;—and I shall direct attention, first of all, to some important facts, illustrative of the *kind of pain*, its *period of attack*, and its *duration*, as elicited from the history of these organic maladies. In these diseases of the uterus, it is impossible, as in those of many other viscera, to recognise particular affections by characteristic pains. The uterus is but sparingly supplied with nerves of sensation; its greatest nervous influence being derived from the sympathetic, the nerve of organic life, through the medium of the hypogastric plexus;—a distribution practically illustrated by the indications of organic disease. Thus, it not unfrequently happens, that the little acute suffering attendant on the earlier and even more-advanced stages of these structural changes creates a false and pernicious security, leading the patient to postpone the necessary examination; and not to seek advice till the bulk of the growth is producing mechanical inconveniences, so serious and confirmed, as to preclude the possibility of more

than partial and temporary relief. Contrast what has now been stated, with what occurs in functional affections of this organ; and the assistance to a correct distinction is still greater; here the pain is immediate and severe, and the implication, through the medium of the sympathetic nerve, of the other abdominal viscera, and oftentimes of the brain, occasions so much suffering as to demand prompt and efficient treatment. Thus in chronic structural disease there is generally little acute, early, or continued pain; while in functional disorders, such as irritation, and in inflammation, these are invariable conditions.

The pains dependent on increased bulk and displacement of the uterus are common to many and diversified affections of the viscus. Supposing the uterus to have attained equal size, the painful indications will be nearly the same, whether the increased volume is produced by chronic vascular congestion, by hard fibrous or even calcareous tumors, by polypii, or by accumulations of fluid or air within its cavity. The suffering here is the consequence of mechanical pressure, and encroachment on neighbouring parts: and in all these cases, the patient will complain of dragging pain in the loins, extending occasionally to the anus and perinæum; of weight and fulness in the hypogastrium, with constipation of the bowels, if the uterus press on the rectum; or of difficult micturition, if it incline forwards and rest on the urethra or neck of the bladder. Again, should the uterus become largely distended at its sides, it may press on the obturator nerve; such pressure being indicated by screwing pains at the hips or inside of the thighs, or in any part of the course of the adductor muscles. A further increase of bulk may involve the sciatic; or, if above the pelvic brim, the anterior crural nerve;—points easily ascertained, by the pain being referred to the course of these nerves. But pains of a like kind are common in some of the displacements of the uterus, especially in prolapsus and procidentia. Nor are the sufferings occasionally attendant on the growth of the gravid womb very dissimilar. The distinction is not, however, difficult: the recumbent posture favours the return of a prolapsed, procident, or ante-verted uterus, and consequently suspends the pain; while the per-

manency of the morbid distentions and growths allows of scarcely any relief to the mechanical pressure, which, although slightly modified by an alteration of posture, is not removed. A variety of indications will ensure a correct opinion, in most cases of pregnancy. One, perhaps, deserves especial notice; viz. that the pain is rarely felt, in this state, during the gradual and natural distention of the womb, but during its premature or healthy contractions.

The *duration* of the pain, and other *morbid changes* dependent upon it, deserve consideration. Whatever might be the symptoms, organic alteration would scarcely be suspected, except from the examples of some very rapid and rare malignant affections, where the suffering and other morbid symptoms had existed only for a few weeks. Such maladies, unlike inflammations and fevers, require months at least, and often years, for their full establishment. Eventually, and principally by mechanical pressure, the functions of other and neighbouring viscera are interrupted; disorganizing changes in their structure afterwards occurring, which ultimately affect the organic growths themselves. Nor, without the examination by touch, or the speculum, can we safely pronounce that there is no ulceration of the uterus, because there is no lancinating pain. It is true, that suffering of this kind generally accompanies ulceration; but numerous instances in the wards, and amongst the out-patients, attest that it is by no means an invariable concomitant. We have, every year, patients in the last stages of these diseases who still do not require opiates, so slight and transient is the pain caused by the ulceration.

Emaciation is regarded as an almost unequivocal sign of structural lesion; and in the truly malignant diseases, it is seldom absent: but in hard tumors of the uterus, even of great size, there is often no emaciation, till the period when ulceration has occurred in neighbouring organs or tissues, and when the tumor itself is beginning to soften and break down. Where, however, the tumor is growing rapidly, or where it is producing irritation by mechanical pressure, digestion is soon impaired, there is little or no appetite, and flesh is sensibly and quickly lost.

I have now enumerated the principal circumstances pro-

perly included in the history of a structural disease: and it may further be remarked, that any event affecting the vital properties or functions, dependent on the real or supposed organic malady, is fairly comprised in this section; the deviations in the anatomical or physical properties of any viscus being the objects of the examination by touch or by the speculum, by the stethoscope, and by the discharges. There will exist other symptoms of less importance, but still deserving of some remark and enumeration. A history of any given case might not be very incomplete without these lesser details; but the diagnostic record of any structural disease must be essentially imperfect, which does not direct the attention of the reader to the age, the temperament, the kind of pain, the duration of the malady, the effect upon the general health, more especially as to emaciation, and the degree of obstruction or difficulty in the functions of the diaphragm, intestines, or urinary bladder.

I shall now pass on to the

EXAMINATION BY TOUCH,

our most valuable means of diagnosis, especially when aided by the speculum and the stethoscope. Here preliminary anatomical knowledge is essential. The practitioner, to whom the healthy structure of the uterus and its appendages is unknown, will try in vain to appreciate the nature and extent of its morbid deviations: he may examine, but he will not know for what he seeks. The pathology of organic disease of the uterus rests on anatomy: a correct diagnosis must, therefore, mainly depend on correct anatomical knowledge.

The anatomy of the uterus, for the purposes of diagnosis, may be arranged in two divisions.

In the first, may be considered its *structure*; and in the second division, its *size, relative position or locality*.

The structure of the uterus is not difficult to be understood. Externally, it is invested by a serous, while within it is lined by a mucous membrane: the covering externally is the peritoneum; while the internal lining is a prolongation of the mucous surface of the pudendum and vagina. Between these lies the proper substance of the uterus, or its parenchyma; made up of its peculiar muscular fibre, its

arteries, veins, lymphatics, nerves, and intervening cellular tissue. It is not necessary to mention the sources whence its supply of blood and nervous influence are derived, because these are points generally known; but I cannot forbear observing, that this simple anatomical arrangement is the key to the study of uterine affections. Each of these parts may be separately the seat of disease: the peritoneum may be inflamed, without the mucous membrane or the parenchyma; and will present symptoms, and changes, strikingly unlike those which shall be produced by inflammation, either of the mucous membrane or the proper structure of the organ. It will not, however, be discovered, that the phenomena accompanying peritoneal inflammation of the uterus differ from those attendant on inflamed peritoneum of other parts, or on inflamed pleura or arachnoid; though the situation of these latter membranes is widely distant; and the functions of the viscera, of which they are parts, widely different from that of the uterus. The same remark is true of the inflammation of the uterine mucous membrane, the progress and results of which closely resemble the inflammation of similar structures in other parts of the body. Nor is the parenchyma of the uterus excepted from this general law. It will be found liable to the like morbid structural and malignant alterations as the parenchyma of other organs.

I must not, however, enlarge; having, in the First Volume of the Reports, directed attention to certain facts of this kind; especially to the difference between structural change in the walls and body of the uterus, and similar disease affecting the cervix of the organ.

The second division of the anatomy of the uterus comprises its *size*, and *relative position* or *locality*.

A minute description of the bulk, weight, and situation of the womb, in reference to the other viscera of the pelvis, is not required; but it is necessary to state a few leading particulars, all of them bearing on diagnosis. The form of the uterus is that of a flattened pear; measuring, from fundus to os, after the full establishment of puberty, and prior to child-bearing, a little more than two inches. After several pregnancies, this dimension will reach nearly three inches.

The weight of the adult virgin uterus, without its ap-

pendages, is not an ounce: after several children, it is seldom less than one and a half, or two ounces.

The breadth of the fundus in the adult virgin uterus is about an inch and a half; and a little more when that organ has been impregnated.

It is placed obliquely in the pelvis; having the bladder in front, the rectum behind, and the convolutions of the ileum above; partially supported by its ligaments, but most effectively by the vagina. The shallowness of the pelvis before, and its greater depth laterally and towards the sacrum, are points of great moment in examination. The fundus of the uterus rises as high as the superior margin of the pubes, lying forwards; and the cervix and os, stretching posteriorly, are nearly in contact with the middle or lower third of the sacrum.

There are two principal methods of examination by the finger: the first, externally, above the pubes; and the second, by the vagina.

Examination by the rectum will often clear up a doubtful point;—the posterior and more prominent surface of the uterus resting on the anterior part of the bowel. The principal facts elicited by the external examination are, *the bulk and form of the organ; its induration, or softness; its precise situation; the effects produced by pressure, such as pain in the part or at a distance, syncope, &c.; and its fixedness or moveability.*

When we attempt to measure the antero-posterior diameter of the pelvic brim, in reference to labour, it is a most favourable circumstance that the finger, in a common examination, cannot reach the promontory of the sacrum; as it is thereby proved, that in this, the principal diameter, there is plenty of room. A similar remark is equally true of the uterus: if, in this external examination by the hand, there is no tumor felt above the brim, or more laterally, it is at least a proof that the viscus does not greatly exceed its normal dimensions. The patient, to afford us every advantage, must be placed in the recumbent posture, on her back, and of course without stays; the shoulders elevated, and the lower extremities flexed upon the trunk: thus, relaxation of the abdominal muscles is fully secured. The

examination will be more easily conducted, if the fat covering the abdomen be gently and gradually kneaded or pushed from the hypogastric region. The bladder and rectum ought to be nearly empty; and the intestines must not be distended with air. Prolonged examination is generally unnecessary; and, without arbitrarily limiting the time, such an inquiry ought never, as a general rule, to exceed a few minutes.

As we presume that there is increased abdominal bulk, our object is to ascertain its precise nature. There may be pregnancy—a hard or schirrous tumor distending the womb, without pregnancy; pregnancy complicated with one or more tumors of the uterus or ovary; or pregnancy co-existing with ovarian dropsy. There may, too, be accumulations of air or water in the cavity of the viscus; although tympanitis and dropsy of the womb, to any extent, are, in my experience, exceedingly rare. Of course, a minute and accurate knowledge of the abdominal region in health, and of the feeling then imparted to the finger by the various viscera, will aid much in the exploration. When there is disease, the difference is truly great between the tact and observation of different practitioners, in visceral affections of this region of the body.

If the growth depend on pregnancy, not to mention the early signs, the situation, shape, and hardness or softness of the tumor will throw much light upon the question. The situation of the tumor, presuming it to be a pregnant uterus, will vary with the different periods of gestation. At the third month, the fundus of the organ will be felt just above the crest of the pubes; while at the sixth month, and afterwards, it will reach and ascend for an inch or two above the umbilicus. Thus, if the examination be made about the sixth or seventh month, provided there be none of the complications already alluded to, the oval form of the distending body—the larger extremity of the oval lying above and forwards, at or a little way above the level of the navel; its freedom from tenderness on pressure; the firmness felt in the tumor, so much greater and more defined than in any part of the abdomen, excepting the region of the liver, owing to the intestines occupying the spaces above and at

its sides; are all of them circumstances confirmatory of the fact of pregnancy. Be it remembered, too, that these changes may all be satisfactorily ascertained, if the coverings of the abdomen are not unusually fat. And even where we meet with this great obstruction, the kneading process will avail much: at all events, the hardness or softness of the growth may be noticed. Hardness, it is true, belongs to schirrous tumors of the uterus; but they are usually lobulated, and sometimes almost stony: while the induration of pregnancy is of even surface, and only of moderate firmness; excepting when the womb is in action, when the hardness resembles that of marble.

I need not pursue this inquiry further. If pregnancy be strongly suspected, the stethoscope will be used; and if the pulsations of the foetal heart are heard, all doubt is at an end.

If the enlargement of the womb result from *schirrus*, even though it be considerable, its diagnosis, where there is no pregnancy, is not difficult. The irregular and uneven surface of the growth, the separate knobs of induration, the number of the tumors where there are more than one, the long time generally occupied in their development, and the symptoms of continued mechanical pressure on neighbouring organs, prevent an erroneous conclusion. It may then be granted, that the external examination will frequently lead us to a correct and decided opinion, in those examples of doubtful enlargement produced solely by pregnancy, or solely by one or more hard tumors of the womb.

But will it suffice, *where tumors of the uterus or ovary, or dropsy of this latter organ, or growths from the broad ligament or other parts of the pelvis* are co-existing with pregnancy?

It may suffice even here, if these morbid conditions were known to exist prior to the pregnancy; and if this latter state has occurred in the usual manner, and is attended by the common and natural signs. Here there would be dangerous complication, but there would be no doubt. It sometimes happens, however, that women marry late; or, having been married early, conceive after many years of barrenness; or, having borne children rapidly at first, leave

off doing so, till they have arrived at that period when the power of reproduction might be supposed to have ceased. Pregnancy in these latter circumstances is often doubted. Structural disease generally occurs at this age; and if the symptoms of the supposed pregnancy are incomplete and irregular, there is fair ground for hesitation. The bulk of the abdomen may perhaps be disproportionate to the presumed period of impregnation; there may be a painful hardness in one part, and a want of proper size in another part of the abdomen; the catamenial suppression may not have been complete; the vaginal discharges may have been rather profuse and unhealthy; and the movements of the child may have been only partially and feebly felt. All these peculiarities may depend on structural disease, co-existing with pregnancy; and several Cases of mine, in a Paper in the First Volume of Guy's Hospital Reports ('on the propriety of inducing premature labour in pregnancy complicated with tumor') prove these statements to be entirely true. In these instances, the opinion was most difficult: the history of the symptoms, and the external and internal examinations, scarcely sufficed for a positive diagnosis. In one of them, the stethoscope detected the beat of the fetal heart: while in another, some doubt existed, till labour pains really occurred: nor was it possible to remove this doubt, as there were two very large tumors developed in the walls of the uterus, in front and laterally; and the placenta was completely over the os.

It is clear that the external examination alone, in such complications, cannot lead to a positive conclusion of what the case really is. The shape, the consistency, whether solid or fluid, and the extent of the abdominal enlargement, may be thus ascertained. The pulsations of the fetal heart, if the child be not feeble or dead, even where there is growth in the walls of the womb, may sometimes be heard through the stethoscope; although it will more frequently happen that this invaluable instrument will be used in vain. I forbear, for reasons hereafter explained, to allude to the placental souffle. All this may have been accomplished, and yet we are far from certainty.

The internal examination by the vagina, and, if necessary,

by the rectum, must be employed. In cases merely of doubtful pregnancy, where there is no suspicion of uterine disease, a cautious practitioner would not commit himself without this internal examination, except he had heard the beat of the fetal heart, or had felt the fetal movements. In those examples, therefore, of abdominal or pelvic enlargement, where pregnancy is thought to be complicated with disease, such inquiry is indispensable; and occasionally, with all the information it affords, we shall hesitate to pronounce a positive opinion. It is far easier, by this vaginal inquiry, aided by the speculum, to recognise, not only the existence, but even the precise nature and extent of uterine and vaginal disease, than it is to determine whether pregnancy really exists in connection with organic change, thus producing the augmented bulk. There are few things so difficult as to form a correct diagnosis in these cases. In my opinion, however, the determination of the pregnancy is the most serious question: for if there be no fœtus in utero, a palliative treatment will be proper; whereas if the patient be pregnant, her safety mainly and almost solely depends on the induction of premature labour.

The solving of this question requires that we ascertain the condition of the neck and mouth of the womb—the size and condition of its body—and the nature of the uterine contents, especially as to motion: if these various parts of the uterus are changed, as in simple and natural pregnancy, the opinion will be certain, and we shall proceed with confidence. The patient must be placed on her left side, the usual obstetric position; and the labia and nymphæ being carefully separated, the forefinger of the right hand will commonly reach and touch the parts satisfactorily. It must, however, be remembered, that the sensitive part of this finger can only examine with nicety that portion of the neck and os lying opposite to it: to examine the whole circumference of the neck, the index-finger of the left-hand must also be used; and then it is scarcely possible that any morbid spot, or induration, can escape detection. As, in the operation of lithotomy, a deep perinæum increases the difficulty, so, in the internal examination, an unusually long vagina,

a broad perinæum, and large and fat labia, present obstacles to the investigation by a single finger. In such patients, two fingers, or perhaps the whole hand, must be used; having been previously lubricated by oil, rather than by any unctuous substance. If the neck be supple, broad, soft without tenderness, and if the os be closely sealed, so far the evidence is in favour of pregnancy. Doubts may arise here; because a polypus may distend the cavity, and lead to development of the neck, but the os would hardly be sealed: the neck itself may be the seat of chronic inflammation, or of hard tumor, generally diffused or confined to one spot; those may be puckered, fissured, or indurated by cicatrices, thus obscuring the indications: but, even here, tact will scarcely fail to appreciate in what degree the indications are to be relied on; the practitioner never forgetting, that all these morbid conditions may exist in the neck of a pregnant uterus. A sealed os would, in a case of such perplexity, avail much: tumors growing from the neck, or os, would perplex, but they would not greatly interfere with the opinion.

The *second* part of this inquiry refers to the body of the uterus. And if the enlargement be globular, arising equally from every part of the circumference of the neck, expanding upwards after the manner of a balloon, affording an elastic resistance to pressure, such indications most probably result from pregnancy. Enlargement, it is true, may arise from hypertrophy, polypi, hydatids, and solid growths of various kinds; but here the resistance to the pressure of the finger would be different; there would be little or no elasticity, excepting where there are hydatids; for hydrometra or physometra need not be included; and there would be a solidity about the uterine mass, which could scarcely be mistaken for pregnancy.

The *third* fact to be discovered is, the nature of the uterine contents; and, especially, whether they possess the power of motion. The stethoscope is not always available, even where the child is living; and where it is dead, it can afford no help. I have already alluded to the different kind of resistance to the pressure of the finger, on the lower part of the body of the uterus. Where there is fluid in the cavity of the womb, the fluctuation; and perhaps the sound, will afford tolerable

evidence: and if the palm of the left hand be placed over the hypogastric region, when impulse is given to the fluid by the finger in the vagina, there will not be much doubt of its locality. If there be a fœtus in this fluid, the same impulse will cause it to rise; and having floated for an instant, it will again subside on the finger. This is termed "*ballotement*," or balancing the fœtus, and can be practised with equal facility, whether it be living or dead.

Examination by the rectum will afford a correct idea of the degree of uterine enlargement, and of the pressure which it exerts posteriorly, and perhaps laterally. It may, too, confirm the impression of the solidity or fluidity of the uterine contents. The morbid peculiarities of the neck, already mentioned, may slightly interfere with the examination of the body; but not so seriously as to prevent our distinguishing, whether the contents of the viscus are hard, heavy, and incompressible, or fluctuating and elastic.

The placenta being entirely or even partially over the mouth of the womb, hypertrophy of the lower part of the organ, or one or more tumors, being situated in its front or sides, will, of course, prevent the certain conclusion which might otherwise be drawn: but we still have the history of the case, the previous pregnancies, if there have been any, the external abdominal enlargement, the examination by touch, and the stethoscope. This, then, is the inference fairly deducible—that although there are cases, where the able employment of all our diagnostic means fails to make us certain of the existence or non-existence of pregnancy, yet that such examples are very few, compared with the number in which such means, used with tact, will conduct us to a positive and correct opinion.

If the indications afforded by the vaginal examination, in doubtful and complicated pregnancy, approach thus near to certainty, the touch, in most of the diseases of the cervix and os, aided by the speculum, must lead to a positive and correct opinion. Often, however, the former mode will suffice; and it ought, in every instance, to be first employed. There is scarcely a case in which the examination by touch may not be used, once at least; while there are not a few in which the inspection by the speculum is absolutely injurious

to the sound, as well as to the unhealthy structures of these organs. By the finger, we can correctly ascertain the size and shape, the consistency, the temperature, and the sensibility of the parts to be examined. Ulceration, or abrasion, may also be detected by the touch, but not with accuracy, as to its nature or extent.

The cervix is seldom more than an inch in length; and is attached to the womb, like a firm, solid nipple. It is lined, both externally and within, by mucous membrane. It differs sensibly from the body of the uterus, being glandular, and, of course, more compact and condensed in its structure; and, so far as I have examined it, without a trace of muscular tissue: it is the channel of communication between the vagina and uterine cavity. Every solid body, whether it be the child, a polypus, a hard tumor, or hydatids, can only find egress through the distended and yielding, or diseased, cervix. All the secretions of the uterine cavity, be they healthy, or offensive and irritating, must pass over its surface: added to which, it is frequently exposed to contusion and inflammation, from sexual intercourse, and from the use of obstetric and other instruments. If it be true, that a part is liable to organic change, in proportion to the excess or even the frequency of its action, we need not wonder that the cervix is so often the seat of chronic inflammation and of structural disease.

Varieties in the form and size, and, to a certain extent, in the structure of this part, are not uncommon: and here it is, that precise anatomical knowledge is so valuable. Often have I been told, that the neck was organically diseased, when, in one or other of its usual conditions, there was only a healthy peculiarity. A cervix, smaller or larger than the natural one, is often met with; and if there be nothing morbid in its structure or function, it is undeserving of pathological attention. The extremes of size may exist in the healthiest women. An elongated cervix is not so uncommon as I formerly supposed. Naturally, the cervix hangs in the upper part of the vagina, not touching its parietes; but if it be of abnormal length, it will, of course, touch the vaginal surface; and if very long, may produce irritation and leucorrhœa. In

estimating pregnancy, and its period, by the development of this part, the possibility of a naturally elongated neck must not be forgotten, as such a variety is one of the exceptions to this indication. The apex, or inferior extremity of the neck, is pierced by an aperture, called the os, of an oval form, and with its long diameter transversely. At puberty, and prior to parturition, it is not longer than a quarter of an inch; while in women who have had several or many children, its length is nearly double. The os is naturally always open; and where the neck has been frequently dilated by the passage of a child, its edges are widely separated, and so gaping, that they will easily admit the tip of the forefinger. In touching these parts, it must be recollected, that the anterior lip is the largest, owing to the chink, or os, not being exactly in the middle of the cervix: it is placed more behind than before—a fact easily proved, by examination. I have never known the os to extend from before, backwards; but I have several times, both in the married and unmarried, and even in women who have borne children, found the cervix remarkably small and compact, perforated by a most diminutive circular aperture, instead of the usual os. Very rarely, there is only the rudiment of a cervix, there being no glandular appendage. The aperture, in this case, is formed in the simple structure of the body of the womb; and slight inflammation may be sufficient for its closure or obliteration. Such an example has been detailed in the *Guy's Hospital Reports**; and Dr. A. T. Thompson's case of dropsy of the womb supplies additional testimony to its occasional, though rare, occurrence.

A large uterus, especially at its lower part, a large and soft cervix, a patulous os, fissured, indurated, and cicatrized, may all exist, without organic, and especially without active organic disease. Prior to, during, and even soon after the catamenial flow, the body, and particularly the neck of the uterus, is larger, and more supple than natural; and imparts to the finger a similar sensation to that communicated in the early months of gestation. Frequent sexual intercourse

* Vol. II. p. 258.

will also induce this state of parts. During natural and healthy menstruation, the orifice of the neck is very dilatable, and easily allows the passage of the finger: this will but rarely occur at other times, independently of disease; and the opinion will be unfavourable, if the finger, on passing into the canal of the cervix, shall touch a puckered, coarse, and rough membrane.

Induration and cicatrization, in slight degree, may result from lacerations during labour, and from the inflammation attendant on their union. In old women, it is especially important to remember, that the cervix naturally diminishes in size, and the contraction of its structure is almost invariably associated with considerable induration;—but still, without disease. It has often occurred to me to verify this statement. I might enlarge here; but the structural varieties already enumerated are perhaps sufficient to guard a careful examiner against error. Deviations more marked and positive than these, attended by pain and discharge, justify a decidedly unfavourable opinion.

It will not be difficult to appreciate morbid change in the consistency of the neck: for although the cervix possesses the firmness of a gland, this may, by a practised examiner, be easily distinguished from the induration, with tenderness, of chronic inflammation; and still more easily from the almost stony or marble hardness of a scirrhous tumor.

Again, the unnatural softness and moisture of this portion of the womb is probably indicative of slightly-altered organization, of slow progress, and less dangerous character, where it is the result of present or former hæmorrhages and leucorrhœa, than where it succeeds diffused or isolated induration. In the former case, it may continue for years, and perhaps to the end of life, without ulceration; while in the latter, it is often the forerunner of that breaking down and malignant degeneration so frequently seen in these structural maladies of the cervix. I cannot forbear to caution the practitioner against a hasty and alarming prognosis, where unhealthy softness is connected with losses of blood and irregular catamenial discharges. Such a condition is

curable ; and occasionally, where little has been done, it has continued for years, perhaps till the final departure of the catamenia ; and the cervix has then acquired its usual firmness. There are other states, not so easily defined, and which can only be recognised by a practitioner frequently in the habit of touching these parts:—on these I cannot dwell.

The sensibility and temperature of the os and cervix are neither of them considerable in health ; and as, in a common examination, the moderate pressure of the finger ought not to produce pain, and as there ought not to be sufficient heat to excite notice, a practitioner can scarcely err in deriving, from these facts, supplementary information. Pain and heat, in high degree, are both present in inflammation of the cervix ; while in the early and more-advanced stages of organic disease they are often, if not generally, absent. Of course, where the disease is softening, and passing through the changes prior to ulceration, there will be more or less of heat and pain.

Abrasion and ulceration may both be detected by the finger, and, in not a few instances, sufficiently satisfactorily to supersede the use of the speculum. Where the former is known to arise from temporary causes, and where the latter is the consequence of the breaking down of hard tumors, the delicacy of the patient may be consulted, without compromising her safety, in abstaining from the employment of this old and valuable instrument.

EXAMINATION BY THE SPECULUM.

It does not come within the scope of this paper, to give the history of the speculum. It may suffice to observe, that, by its use, the eye, as well as the finger, is made to assist in the diagnosis of organic diseases of the neck and orifice of the womb : for while the touch enables us to recognise structural changes in the bulk, firmness, and sensibility of these parts, the sight rectifies and perfects an erroneous or incomplete opinion, by shewing the *nature and limits of ulceration, excoriation or eruption*, the *appearance* of the cervix and vagina in various stages of disease, and the *colour and consistency* of the accompanying discharges.

The best and most easily used speculum is made of tin,

with an inner, highly-polished surface. There need be no division in the cylinder, and the complicated screw is not required. I have, for hospital use, a series of these conical tubes, of various sizes; and the previous introduction of the finger into the vagina enables me to select the right-sized speculum. The length of the tube should be from five to seven inches, and it may or may not have a handle: on the whole, it is, perhaps, more readily used without one. The strong light of the sun is the best for these examinations, but a candle is an excellent substitute.

The rules prescribed for the introduction of obstetric instruments into the vagina will serve here. The labia being widely separated, the speculum is to be carefully and slowly passed, backwards and downwards, towards the point of the coccyx. The principal obstacle is at the entrance of the vagina; for when the resistance of its sphincter is once overcome, the speculum will easily traverse the rest of the canal. Care must be taken that the transverse portion of mucous membrane, placed posteriorly, called the *fourchette*, is not stretched and carried forward by the instrument, as great pain and difficulty in the introduction will be the result.

The position of the neck is occasionally changed, being placed more forward or posteriorly than natural. To obviate this difficulty, and to bring the cervix within the end of the tube, the speculum must be elevated or depressed. Sometimes, from spasmodic contraction, induced by the passing of the cylinder, a fold of the mucous membrane of the vagina is forced into the aperture of the speculum, and may be mistaken for the cervix: the least movement, however, of the instrument will cause the slipping away of the portion thus placed; and the recognition of the neck, which is glandular, smooth, and without rugæ, and paler than the vagina, is not difficult.

The whole circumference of a very large cervix cannot be examined at once: the position of the speculum requires attention; and if the parts are not morbidly sensitive, the instrument is easily and safely turned in the vagina: this caution is important; as very lately I overlooked a rather large ulcer on the inferior and posterior surface of the neck, from a neglect of it.

We may, then, by the speculum, accurately ascertain the different external morbid conditions of the cervix and its orifice; and in many instances, where the os is entirely or even partially open, the nature and extent of disease affecting the cavity of the neck may be readily known. And although the structural changes of the body and walls of the uterus do not admit of elucidation by the speculum, still the growths of its lining membrane are not entirely beyond the reach of its diagnostic agency: for if large, they will descend towards the orifice of the viscus; and if ulceration affect the uterine cavity, it is most probable that it will eventually reach the neck, and thus be brought within the scope of the speculum.

In health, the cervix uteri is, externally, of pale colour, having the aspect of polished skin; and it is easily distinguished from the lining membrane of the vagina, which, from its different structure and greater supply of blood, has a much deeper tint of red. These parts are naturally covered with a thick mucus;—a fact of importance, as, if it be not removed by lint or a soft brush, abrasions or ulcerations, being thus obscured, might be overlooked.

Valuable as is the speculum, its use has been indiscriminately and unnecessarily urged. In slight cases of uterine irritation and leucorrhœa, its employment is prejudicial; while, in leucorrhœal discharges of long standing, and in menorrhagia of months' and years' continuance, its introduction cannot be too strongly recommended: for it must never be forgotten, that these maladies rarely exist long, without more or less of organic change. If there be a suspicion of structural mischief about the lower part of the uterus, there ought to be no delay, not only in touching, but in seeing the seat of the suspected disease.

There are circumstances which entirely forbid the employment of the speculum. In very young and very old persons, its introduction is difficult, and sometimes altogether impossible, without laceration. The hymen in the young, and the great shrinking and contraction of the vagina in aged women, present obstacles so serious, that the use of the speculum ought to be given up, unless the necessity

be extremely urgent. I have several times found membranous bands stretching across the vagina, and contractions of its caliber from cicatrices; which would have entirely impeded the passage of the instrument. There was lately an out-patient of mine at Guy's, whose vagina was so funnel-shaped at its upper part, as to preclude my touching the os or cervix, except by a probe, introduced through the minute aperture at the apex of the funnel by which the catamenia escaped from the uterus. Steatomatous tumors occupying the walls of the vagina, ovarian growths in the recto-vaginal septum, polypi, deep ulcerations of the vagina or neck of the uterus, large cauliflower excrescences, or bleeding fungi, all contra-indicate the use of the speculum. When the neck is inflamed, or much congested, or where the vagina is excessively sensitive, the introduction of the speculum should be deferred, till these various morbid conditions are ameliorated.

Making every deduction, which the enthusiasm of some individuals in its favour demands, the speculum must be regarded as a most important addition to our diagnostic and curative means. It enables us not only to discover and nicely to distinguish the concealed diseases of the most complicated portion of the womb, but, by the light which it throws upon the seat of the mischief, it affords us great facilities in the exact application of our remedies. It is much to be wished that the advantages which it is capable of conferring were more early and extensively realised.

THE STETHOSCOPE

Is solely valuable, as a positive indication, where the beat of the foetal heart is heard. It is only, therefore, in those diseases of the womb where pregnancy is suspected, that we require its aid. The "placental souffle" may be thoroughly imitated by the pressure of a tumor on the iliacs. In Petersham Ward, my attention was called, by Mr. Oldham, to two of my patients, lying within two beds of each other; the one suffering from a hard tumor of the uterus, extending towards the left side; the other, in the seventh month of pregnancy, and enduring great pain from a malignant, and, in a few weeks, a fatal disease of the

external genitals. In the latter patient, the "placental souffle" was readily detected, over the greater part of the upper portion of the uterus, beating synchronously with the maternal pulse. In the former, a very distinct "bruit de soufflet," as loud, and nearly as perfect as in the pregnant patient, was perceptible. This sign did not embarrass the diagnosis, as the tumor was not fixed, and could easily be removed from the iliacs, the "bruit" ceasing with its altered position. The sound, in both cases, was nearly identical: perhaps the "souffle" of pregnancy was more prolonged, and less sharp than the other.

THE DISCHARGES.

This paper is already so much longer than was intended, that I feel unwilling to do more, than very briefly to allude to the Discharges; reserving to myself the opportunity afforded by another Number of the Reports, to enter more fully into the subject. I may, however, remark, that the uterine discharges, as well as those from the vagina, have for a long time afforded the principal means of diagnosis, where an examination was not permitted. The knowledge so derived, independently of the touch and the speculum, is restricted and uncertain. A white discharge may be the attendant of so many different and even opposite conditions, that to regard it as a sure criterion of any one or two lesions would lead to frequent mistakes. To discriminate accurately between a mucous and purulent discharge is often difficult, unless, indeed, both were placed together, and tests applied for each; and even then, an examination by touch and the speculum could alone determine what particular structure was affected. The prevailing notion, that a purulent discharge is yellow, and a mucous discharge white, is incorrect; as the latter may assume every shade of colour between a white and a light green. Again, as the os externum is the common outlet for the morbid secretions of the entire mucous membrane of the vagina, cervix, uterus, and Fallopian tubes, each of which may be differently affected at the same time, it is obvious that an intermixture of several discharges may be submitted to our inspection, which must prevent an accurate diagnosis.

OBSERVATIONS
ON
ABDOMINAL TUMORS
AND
INTUMESCENCE:

ILLUSTRATED BY SOME CASES OF ACEPHALOCYST HYDATIDS.

BY DR. BRIGHT.

As it is my intention to devote the present and some future communications to the consideration of Abdominal Tumors and Intumescence, it will be well, in the first place, to give a general outline of the subjects which may probably be included in such a survey; although it is not proposed to adhere closely to the line marked out, but rather to take up the various points, as circumstances may render most convenient, or the Hospital afford me the requisite means of illustration. The topics which naturally present themselves admit of being arranged under the following heads:—

1. The Integuments; 2. The Peritoneum; 3. The Stomach; 4. The Intestines; 5. The Liver; 6. The Spleen; 7. The Pancreas; 8. The Mesenteric Glands; 9. The Kidneys; 10. The Bladder; 11. The Uterus; 12. The Ovaries; 13. Extra-Uterine Bodies; 14. Aneurism.

1. The Integuments; including various cutaneous changes, polysarcia — anasarca — malignant deposits — abscesses — protrusions.

2. The Peritoneum—the various results of inflammatory action; as, effusion, including ascites—adhesions, and various depositions of adhesive matter—tubercular deposits—malignant diseases—hydatids.

3. The Stomach; including flatulent distention—chronic disease—malignant changes.

4. The Intestines; including flatulent distentions—re-

tained feces, and other matters—mechanical obstruction—malignant strictures.

5. The Liver; enlarged from congestion—forced down by the lungs, or by effusion—distended with bile—enlarged by various changes of the structure generally—enlarged by malignant growth.

6. The Spleen; enlarged by congestion—changed in structure.

7. The Pancreas; enlarged, or hardened.

8. The mesenteric glands; simple enlargement—scrofulous, malignant, and osseous changes.

9. The Kidneys; enlarged by vesicles—by abscess—by malignant disease—distended ureter.

10. The Bladder; distended—thickened—forced forward.

11. Uterus enlarged from pregnancy;—chronic increase—scirrhus disease, and other changes.

12. Ovaries; enlarged by simple cysts—by malignant growths.

13. Extra-Uterine Fœtation.

14. Aneurismal Tumors; celiac—aortal—iliac.

The sources to which we turn for evidence respecting the existence and nature of abdominal tumors, are, the form and appearance presented to the eye; the form still further discovered by the touch; the resistance ascertained by pressure; the sounds elicited by percussion; and, in a few instances, the sounds perceptible to the ear, either alone or by the aid of the stethoscope: and besides these local and physical signs, we look to the general condition of the system, and of the various excretions, as rendering us most important assistance, and being frequently indispensable towards the formation of a tolerably correct diagnosis.

In studying the local indications of disease, the first object is, of course, to learn and fix in our minds the exact normal position of each viscus, and the modifications of form, appearance, and resistance which the muscles of the parietes are capable of impressing upon the different parts of the abdomen. There is, however, one circumstance connected with the abdominal viscera, which must always throw a certain degree of doubt upon all physical diagnosis, as

directed to this part of the body; and this is the diversity which sometimes takes place in the organs themselves, and that more particularly with regard to the colon; the arch and the sigmoid flexure of which not unfrequently form extensive convolutions, which render any inferences derivable from its natural position somewhat doubtful. The liver, likewise, occasionally deviates from its ordinary situation and form; and, in rare instances, an anomalous position of the kidney, or other organs, may be a source of fallacy: still, however, these deviations are not sufficient to interfere materially with our probable conjectures, though they must, of course, place a bar to that perfect certainty which it would be desirable to obtain, and which, at all events, it would be very satisfactory to look forward to, in such an important research.

To facilitate our investigation, and to render our reference more exact, it has been found necessary to divide the abdomen into regions, by drawing imaginary lines, or passing imaginary planes, through the body. The divisions which have been proposed vary a little, on account of the irregular form of the abdominal cavity, and the difference of the fixed points assumed by various observers; but the following, which I venture to lay down with the assistance of my friend Mr. Edward Cock, will perhaps approach as nearly as any to a useful, though still an artificial and somewhat variable subdivision of this part of the body: and to render the subject still more obvious, I have drawn an outline of the male and female figure, with the divisions marked upon them. (PLATE I.)

The first general division will be into three regions—the upper, the middle, and the lower; or, the epigastric, the umbilical, and the hypogastric.

The epigastric region is bounded above by the diaphragm; below, by a horizontal plane passing through the anterior extremities of the tenth rib of either side. In a well-formed chest, the cartilage of the tenth rib offers a projection on its convex or lower edge, just as it is leaving the bone, and rising towards the sternum; and this may generally be felt, without difficulty, on the living subject. It must, however, be observed, that the situation of the two points, which have thus

been chosen to mark the lower boundary of the epigastric region, vary somewhat in different subjects, according to the size and shape of the chest; and in the female, more especially, are often found to have undergone considerable alteration from their original position, owing to the constriction produced by the long-continued use of tight stays. A horizontal plane, carried backwards, through these points, will pass between the bodies of the first and second lumbar vertebræ; and emerge posteriorly, just at the lower edge of the spinous process of the former.

The upper boundary of the epigastric region, being formed by the diaphragm, varies in its position, at each effort of respiration. Anteriorly, it corresponds with the junction of the ensiform cartilage with the sternum; but from this point it will be found to descend from before, backwards towards the spine, and on either side towards the ribs, until it reaches the lower boundary of this region.

The epigastric region is subdivided into the right and left hypochondria, or the spaces enclosed by the false ribs; and the *scrobiculus cordis* in the middle, covered in merely by the abdominal muscles. This latter is much broader below than above; as may be seen by referring to the skeleton.

The umbilical region is bounded above by the lower epigastric plane; and below, by a horizontal plane passing through the anterior and superior spinous processes of the ilia. This plane, if produced backwards, will cut through the centre of the second portion of the sacrum, on the anterior or concave surface of that bone; and emerge posteriorly, between the second and third sacral spines. This region is likewise subdivided by imaginary planes, as will be shewn hereafter.

The hypogastric region is bounded above by the lower umbilical plane, and below by the upper margin of the pubes in the centre, and Poupart's ligament on either side; the latter forming two divergent lines, extending from the spinous processes of the pubes, upwards and outwards, to the spinous processes of the ilia. This region may be said to be extended into the hollow of the true pelvis, occupying its whole cavity, and continued to its lower outlet. A horizontal line passed backwards from the upper edge of the

symphysis pubis nearly corresponds with the extremity of the œcœum.

The umbilical and hypogastric regions are each divided into three, by two ascending planes passing directly backwards, and drawn through the spinous processes of the pubes and the points on the tenth ribs, already alluded to as marking the lower epigastric plane. These planes diverge from each other; and if continued over the chest, will pass rather to the outside of the nipple in the male, until they reach the clavicle, not far from its scapular extremity.

The umbilical subdivisions thus produced, consist of a central region, which retains the name of 'umbilical,' and two lateral regions. These last may be again divided into the iliac fossæ below, corresponding with the venter of the ilium; and the lumbar region above and behind, comprising the space between the lower epigastric plane and the level of the crista of the ilium. The deep fossæ on either side of the bodies of the lumbar vertebræ have more particularly received the name of lumbar regions.

The hypogastric subdivisions consist of the middle or pubic, which descends into the cavity of the true pelvis; and the lateral or inguinal regions. These latter comprise but a small extent of surface; and are likewise exceedingly shallow, in consequence of the approximation which here takes place between the anterior and posterior abdominal walls, previously to their union at Poupart's ligament. Indeed, the serous cavity of the abdomen may be truly said to terminate at a line a little above Poupart's ligament, where the peritoneum becomes reflected, from the fascia transversalis before, on to the fascia iliaca behind; thus rendering the inguinal region of the belly smaller, from above to below, than its external boundaries would appear to indicate.

Assuming these, then, as the regions into which the abdomen may be divided, it is evident that they will not correspond exactly with the extent and form of the different viscera; but that one division will often contain portions of several viscera, and one viscus will occupy portions of several divisions. Generally speaking, however, the position of the different organs will be as follows:—The epigastric

region will contain, in its whole length, the liver with the gall-bladder, the stomach, the contents of Glisson's capsule, the two angles and part of the arch of the colon, the duodenum, the spleen, the pancreas, the renal capsules, and a portion of each kidney; together with the aorta, the cava, the celiac axis, and the commencement of the superior mesenteric artery.

The middle portion of the upper region, which is called the *scrobiculus cordis*, contains the whole of the left lobe of the liver, and a part of the right; together with part of the gall-bladder, the ducts and Glisson's capsule, the pyloric end of the stomach with the commencement of the duodenum, a portion of the colon, the pancreas, the aorta, and the celiac artery with the cava and superior mesenteric artery.

The right hypochondrium contains nearly the whole of the right lobe of the liver, the angle of the ascending colon, the greater part of the duodenum, the renal capsule, and the upper portion of the kidney.

The left hypochondrium contains the rounded cardiac portion of the stomach, at all times; but a very large part of that organ, when distended, the left angle of the colon, the spleen, and a small portion of the left kidney with the renal capsule.

The central subdivision of the umbilical region, which may be called the 'umbilical region proper,' is chiefly occupied by a portion of the arch of the colon, the omentum, and the small intestines; and contains, likewise, the mesentery and its glands, the aorta, and the vena cava.

The right lumbar region, again subdivided into the 'lumbar region proper,' and the iliac fossa, contains the cæcum chiefly lodged in the iliac fossa, the ascending colon, the lower and middle portion of the kidney, a portion of the ureter; and, as it is bounded posteriorly by the lumbar and psoas muscles, these parts may be considered as entering into its composition.

The left lumbar region, also subdivided as the right, is occupied by the descending colon, and, chiefly in the iliac fossa, by the sigmoid flexure, the left kidney, and the ureter.

The small intestines likewise occupy the lumbar regions on either side, and cover the ascending and descending

portions of the colon. The lower or hypogastric division is the smallest of the three.

The central subdivision, termed the pubic region, contains the urinary bladder with portions of the ureters, the rectum, and sometimes a projecting convolution of the sigmoid flexure of the colon; together with some portions of the small intestines, more particularly the lower convolution of the ilium, and, in the female, the uterus and its appendages.

The two lateral subdivisions of the hypogastric region, termed the inguinal regions, are very limited: the right sometimes contains the lowest part, or *cul de sac*, of the caput coli, and the vermiform process and the iliac vessels.

The left inguinal region contains a part of the sigmoid flexure, and the iliac vessels of that side.

Such, then, is the distribution of the different parts and viscera, in their healthy and quiescent state: but they are subject, as I have said, to some variations, from anomalous formations; and besides this, many of the viscera, particularly those which are hollow, undergo considerable changes, as to form and extent, according to the state and progress of the operations in which they are destined to assist: and we must, of course, be prepared to appreciate and make allowance for such changes, when investigating the condition of the abdomen, or speaking of the natural contents of its different artificial subdivisions.

With a view of assisting in registering facts, it appears very desirable that every one, who is really anxious to make the most of the experience which comes within his reach—a duty which, unfortunately, from the time it occupies, we are all too apt to neglect—should provide himself with some ready mode of transferring to the corner or the blank page of his note-book an outline of the abdomen; upon which he may mark, as nearly as possible, the exact position of any tumor which he is called upon to treat: and, for this purpose, I have employed one or two different little contrivances, which it may not be amiss to mention. In the first place, having drawn on a thick sheet of paper the outline desired, we may, with a pin, make holes in a few prominent points; and pricking the note-book through these holes, the least-

experienced draftsman will be enabled to make an intelligible sketch in a very short time. I have likewise had the figure cut in a brass plate, to use it in the mode of stencilling; and have thus procured, in a few seconds, upon any part of the page, such an outline as is represented in the figures in Plate II. Again, it would be a matter of a very few shillings' expense, to have a wood-cut or type formed, which might be used like a seal, even with common ink. It is obvious that no one single sketch can serve for every case; because the relative proportions of the different parts of the abdomen are somewhat altered, as it becomes distended, and consequently thrown out of its natural form; but still, the convenience of some such mechanical contrivance is very great, and there is no difficulty in being provided with more than one form of outline; and perhaps a second, representing the moderately-distended abdomen, would be quite sufficient for every purpose. It will be at once perceived, by a reference to the Plate, how the situation and extent of tumors, whether visible to the eye or ascertained by the touch, may be traced on the outline; and thus remain a fixed record, by which to judge of the progress of the individual case, or afford a means of comparison with others.

ACEPHALOCYST HYDATIDS.

It is intended to confine the present communication to the illustration of abdominal tumors derived from a single disease; which, though not strictly an affection of the peritoneum, yet, as most extensively occupying the peritoneal sac, or the parts immediately covered by that membrane, may be arranged, for convenience, amongst its diseases.

Of the origin of hydatids we are so completely ignorant, that it would be vain to hazard a conjecture on the subject. They are believed to be independent animals, existing without any vascular connection with the body in which they are developed; but whence the ova are derived, or how introduced into the body, is altogether unknown. They are confined to no particular organ; having been found in the abdomen, the chest, and the pelvis, and various

other parts; occupying, indiscriminately, the glandular, the muscular, and the cellular structure; but, undoubtedly, the most common situation is somewhere in the abdominal region: while, of the individual organs, the liver is most frequently affected by them; and, in many cases, it is probable, that when they have ultimately occupied a larger space, and spread more extensively through the abdomen, they have originally been situated in the liver only. Almost the only indication of their existence, at the commencement, is the occurrence of swelling, corresponding with the part in which they are situated; and the gradual increase of this is, for a time, the chief mark of the progress which the disease is making. Occasionally, when a rounded projecting elastic tumor has been observed and felt for a time, a sudden subsidence takes place, accompanied by more or less constitutional and local excitement; and then the tumor may never arise again; or, instead of one definite tumor which had before been observed, several may appear to develop themselves within a limited period: at other times, the sudden disappearance of such a tumor may be followed by symptoms indicating peritoneal inflammation, so severe, as quickly to lead to dissolution. In a few instances, the subsidence of such a tumor is attended by the evacuation of hydatids, through the lungs, or the intestines, or in some other way, attended by various results.

The tumor which presents itself externally is most commonly, at first, distinctly referrible to the liver; and either occupies the right hypochondrium, or, protruding from beneath the ribs and their cartilages, encroaches upon the middle subdivision of the epigastric region, or descends into the right lumbar region, or approaches the umbilicus: its form is rounded, and its feel elastic; sometimes varying a little in the resistance it presents, being occasionally hard and even bony in some parts, and often indistinctly fluctuating on percussion. When situated in the right hypochondrium, it is sometimes accompanied by jaundice. When situated in other parts, the derangement of the functions of the particular organs upon which pressure is made will afford collateral indications not to be neglected. This form of disease is not confined to any age, or either sex; and the

length of its continuance is not ascertained, though it is certain that it may exist for a great number of years without destroying life, as will be shewn by some of the cases I am about to state.

Neither the situation, nor the sensation yielded to the touch, will be found to afford a complete means of diagnosis, in cases of hydatids: for, as I have said, they may occupy any part of the abdomen, and may arise from, or encroach upon, any organ: and this source of difficulty will be well illustrated by the diagrams, Plate II.; in which Fig. 1. represents the sketch I took in a case of cerebriform disease of the abdomen; while Fig. 2. is a similar sketch from a case of hydatids. In these cases, the liver was, in both, the seat of elastic tumors; and so likewise was the space corresponding to certain convolutions of the intestines. There was, it is true, an appreciable difference in the feel: in the case of the hydatids, the elasticity was greater; but as the tumors in the other case were full of soft cerebriform matter, they were by no means devoid of a degree either of elasticity or of imperfect fluctuation. It is therefore quite necessary, in all cases, to call to our aid the concomitant circumstances. Thus, in the present instance, the greater constitutional affection, the general irritability of the system, the sallow and unhealthy complexion of malignant disease, and, on the other hand, the slowness with which hydatid tumors develop themselves when compared with cerebriform disease, would be amongst the most decisive marks, confirming or modifying the conclusions to which situation and feel had led.

CASE 1.

Hydatids in the Abdomen, of many years standing; shewing the Acephalocysts in almost every stage of their existence.

ANN WILLIAMS, aged 54, was admitted into Guy's Hospital, under my care, August 15th, 1827, with a peculiar swelling of the abdomen; her health at that time suffering so far, as to make her feel all exertion irksome. It appeared, from her account, that she had given birth to her first child, which was still living, about fourteen years before;—that,

about two years after, she bore a second healthy child, which was her last. She never thought that she returned completely to her natural size, after her first confinement; but it was not till nine or ten years ago that she suspected any unnatural condition of the abdomen; and the enlargement was so gradual, that she was unable to say whether it began in one part more than another; nor was it till about three years ago, that the swelling, gradually assuming its present appearance, very decidedly attracted her attention. At the time of her admission, the whole abdomen was greatly enlarged; the upper two-thirds occupied by an irregular tumor, indistinctly fluctuating, and, in various parts; somewhat tender on pressure: the lower part of the abdomen was also occupied by a fluctuating tumor, apparently a large cyst arising from the pelvis. The intervening space was soft; and, was the only part which gave a clear or tympanitic sound on percussion. She complained chiefly of constipated bowels and loss of flesh, although her appetite continued good. During the first months that she was in the hospital, she remained chiefly in bed, sitting up but little; not so much from any feeling of positive illness, as from the uneasiness produced by the weight of the tumor. She lay down without suffering any inconvenience, or any additional dyspnœa. Her urine was clear, and not in the least coagulable; and there was no anasarca swelling at any time. In October, she complained, on several occasions, of increased pain and tenderness in various parts of the abdomen, which were always much relieved by the application of ten or twelve leeches: she at the same time took gentle bitter and tonic medicines, and occasional purgatives; amongst which I found none more efficacious than five grains of the hydrarg. c̄ cretâ, followed, in four hours, by castor-oil. On the 29th of October, she complained much of uneasy sensations in the abdomen; which she spoke of as throbbing, starting and jumping, and was apprehensive that suppuration was taking place; and at two or three separate periods, in November and December, she was affected with faintness and cold perspiration, continuing for half an hour, and followed by a sense of lowness, and a feebleness of pulse, which lasted for a

day or two. The breathing all this time was strong and clear, and the bowels regular.

December the 31st, a dull aching pain came on, in the lower part of the abdomen, with slight tenderness on pressure. This was followed by a diarrhoea; which continued, in some degree, for ten days, with occasional attacks of sickness and vomiting. She again returned to a more comfortable state; but in the middle of February suffered some pain in the abdomen, which she sometimes compared to the formation of an abscess, and, at other times, to something suddenly running through her. In the latter part of this month, the urine became high-coloured and very scanty, with pain in the loins: and on the 27th, hæmaturia took place, the urine throwing down a brown flaky coagulum, on exposure to heat. The countenance was now beginning to lose the healthy appearance it had hitherto maintained, becoming sallow. The hæmaturia continued for several days. Throughout the months of March, April, and May, she suffered occasionally from rigors, which continued for two or three hours; and her stomach became so irritable, that she often rejected her food almost as soon as it was swallowed, or experienced pain if it was retained. Diarrhoea returned in the beginning of June; and on the 10th of that month she expired.

I have not thought it necessary to detail the various remedies which were administered during this protracted illness: they were throughout directed rather with a view to relieve symptoms, than with any expectation of curing the disease, which, from the first day of her admission, I plainly perceived to be beyond the reach of medicine. The tumor of the abdomen had already existed for several years; and from its peculiar and irregular forms, and its obscure fluctuation, I concluded that it consisted either of hydatids extensively distributed, or was an ovarian tumor; and if the latter—which, from its very singular form, and more particularly from the existence of the upper portion so separated from the lower, I could scarcely believe—I supposed that it must be one of those complex and malignant forms of disease which could afford very little prospect of

permanent relief from paracentesis. This remedy, however, I proposed to the patient, who was a remarkably sensible and well-educated woman, shortly after her admission, and again when the irritability of the stomach became urgent, probably from the pressure of the tumor; but I was obliged fairly to confess, that I considered it an experiment of doubtful issue, and only likely to give temporary relief.

The day subsequent to her decease, the body was examined, in pursuance of her own particular request, made to me during life, and likewise left in writing on her death.

SECTIO CADAVERIS.—The body was extremely emaciated. The abdomen presented two large tumors, the one occupying the lower, the other the upper part, projecting greatly, and divided by a soft yielding portion. (Plate III. Fig. 1.) When the integuments were turned back, two large cysts came into view; between which, the arch of the colon was seen, in a very contracted state, passing across the abdomen; while the small intestines, likewise greatly contracted, chiefly occupied a triangular space in the right lumbar region. (Plate III. Fig. 2.)

The lower cyst was nearly spherical; and on its anterior surface, to the right of the centre, was seen a flat triangular body, from which a long line extended upwards towards the left; and besides this, several nerves and vessels were stretched on its surface. On further examination, this triangular body proved to be the uterus, compressed to half its natural thickness, and proportionably extended in surface; and the line from it was one of the Fallopian tubes, closely united to the cyst. On making a small incision into the tumor, nearly a gallon of perfectly limpid fluid escaped; and then several hydatids, each of the size of a hen's egg, presented themselves at the opening. It now appeared that the whole of this enormous cyst was closely lined by one hydatid, the thickness of which was as great as tolerably thick wash-leather. It was transparent, and easily torn, and fitted, in all parts, closely to the sac in which it was contained; but was so slightly attached, that it might have been torn away perfect, by the application of very slight force. The

sac itself had its inner surface of a bright pink colour, and appeared very vascular.

Behind, and to the left of this large cyst, a smaller one was discovered, of the size of a very large hen's egg, which was attached to the left ovary, and proved to be of the same nature as the large cyst; but in this, the hydatids, instead of being entire and spherical, were all burst; and that which appeared to have served at one time as a lining to the sac, was found, when taken out and examined, to be at least four times as large as the whole superficies of the present cavity.

The superior tumor of the abdomen was attached to the liver, in the substance of which it was partly imbedded. The upper part, where it had come in contact with the integuments, was completely cartilaginous; and a very singular appearance was discovered by raising the body of the tumor. There were a great number of enlarged absorbents, filled with a puriform fluid: they were quite varicose, of the size of the iliac artery after its division. One of these was seen of the length of two or three inches; while others were convoluted, and assumed a cellular appearance. Owing to the weakness of their coats, they were mostly flattened, collapsing like veins. When an incision was made into this tumor, the fluid which escaped was turbid, and of a yellowish-white colour; and it was chiefly filled with hydatids, in all their different states and stages; but by far the greater number were compressed and broken, the shreds and empty cysts being compacted together; while several, even of the size of an egg, were unbroken; and from this cyst, again, nearly a gallon of fluid and of hydatids was collected.

To the left of the gall-bladder, which was itself seen in a tolerably natural condition, was another cyst, about a third part as large as the one we had just opened: and in this case, the bile had communicated with the cyst, and the fluid it contained was green and turbid; while the hydatid cysts floating in it, and chiefly broken down, were deeply tinged of the same colour; and the internal surface of the general cavity, to which probably an hydatid had formerly been attached, was now scabrous to the feel, and covered with

yellow and dark olive-coloured particles, apparently inspissated bile.

With regard to the viscera, the stomach was greatly compressed by the tumor appended to the liver; and the contracted condition of the intestines bespoke the scanty supply of nutriment which had passed into them during the last weeks of life. The kidneys had suffered most materially from the pressure made upon the ureters, and were almost reduced to the state of membranous sacs. The right was the larger of the two, and was distended with grumous bloody urine. The inner surface of the pelvis approached, in one or two parts, to a condition of ulceration, or sphacelus. The liver was granulated, of a light colour and soft texture. The lungs were healthy, with the exception of some œdematous effusion. The heart was flabby, and of a light colour.

As to the hydatids themselves, they seem to have varied from the size of the large cyst in the lower part of the abdomen to the minutest object capable of being seen by the eye: many of them were of the size of a hen's or a thrush's egg; and these were often studded internally with little rounded bodies of an opaque white colour, which, when separated from the surface, floated for a little while in the fluid, and then gravitated to the bottom. It was observable, that the coats of the hydatids were elastic, and admitted of an almost indefinite division into smooth and even lamellæ.

As, in this case, the hydatids were exceedingly numerous, and presented themselves in various forms, I availed myself of my friend Dr. Roget's kindness, and submitted many specimens to observation under the microscope he had lately obtained from Amici; and I procured, at the same time, the assistance of Mr. Say, of whose talents as an artist I need say nothing, in delineating some of the appearances they presented.

An hydatid, of about the size of a pigeon's egg, taken from the lower cyst, having been carefully ruptured, was found to contain almost innumerable small hydatids, scarcely visible to the eye: and a little group of them, not exceeding in size, altogether, a few grains of sand, being examined by the

third power of Amici's microscope (Plate IV. Fig. 3), was found to consist of simple hydatids, and of such as, having generated others within themselves, might be considered as pregnant or prolific. The single minute hydatids generally inclined to an oval form; and all of them appeared to be studded within by innumerable points or inequalities, giving them a spotted appearance; the specks being light or dark, according to the direction in which the light fell upon them. These single hydatids seldom completely touched, and never compressed each other as they lay. The pregnant minute hydatids contained from two to twenty, or more, within them: they were exceedingly thin and transparent, so as but little to obscure the appearance of the contained hydatids, by the projection of which they frequently seemed to be changed from their regular ovoid or spherical shape.

Another hydatid, of the size of a thrush's egg, but exceedingly transparent, was examined, without being broken, through Amici's third glass (Plate IV. Fig. 1). It appeared as if it were covered internally with innumerable small projections, hardly larger than those seen within the small single hydatids I have just described; while, at the same time, a few vesicular bodies were seen within; but whether floating in the fluid, or adhering to the sides, could not be determined.

A portion of an hydatid, about the size of a pigeon's egg, being taken so that a part of the internal surface was seen at the edge, as the membrane coiled upon itself (Plate IV. Fig. 4), groups of single small vesicles were seen attached, almost like clusters of grapes closely set upon a branch; an appearance which I had several times an opportunity of seeing and drawing (Plate IV. Fig. 5).

A similar portion of another hydatid being examined, it was observed, that over a considerable part of its surface a botryoidal appearance prevailed (Plate IV. Fig. 2), from the elevation of oval bodies like compressed single hydatids, transparent and spotted as the other minute single hydatids had been; and some of these hemispheres projected more than the rest, either forming little clusters, or apparently attached to the surface by a footstalk formed of a portion of

lining membrane drawn out from the parent hydatid: and on examining some portions of the internal surface, an appearance of a number of very minute rents and oval depressions was seen, not improbably left by the escape of hydatids from their nidus.

There is every reason to believe that the disease in this case had existed ten, or probably twelve years, before it proved fatal; for to that period could the patient trace the gradual enlargement of her abdomen. The progress of the symptoms corresponded well with the appearances discovered after death: and from the condition of the various cysts, I think we are authorized in concluding that the hydatids had first developed themselves in the liver. The disease, perfectly local in its nature, had given rise to no urgent symptoms, till the tumor pressed upon the ureters, and thus mechanically produced irritation and absorption of the kidneys; and afterwards, by its pressure on the stomach, as well as by the sympathy of the stomach with the kidneys, it interrupted the function of that organ likewise. It is difficult to say what was the cause of those faintings, peculiar sensations, and rigors, which were frequently experienced from the month of October. They might possibly have been connected with changes taking place within the cysts; and I was, at the time, inclined to consider them in that light, thinking it not improbable that something analogous to the constitutional impressions which have appeared to take place when the cysts of ovarian tumors successively burst might be thus produced: but I believe that the operations and changes of the hydatids themselves would have very little influence on the patient; it is rather those diseased actions, and that absorption, which takes place from the cavity in which the hydatid is contained, that may be looked upon as the sources of the serious and distressing symptoms which attended the concluding periods of this patient's life.

There can scarcely be on record a more instructive post-mortem examination, as regards the history of the disease; containing within itself, as has been seen, a most singular variety of the different states and conditions in which the

hydatid presents itself. The four principal masses into which these were distributed each afforded its remarkable peculiarity. In the large inferior tumor, the whole economy of the hydatid was in its most flourishing and healthy state. The parent, or protecting cyst, accurately lined the cavity in which it was contained; and the numerous progeny might be supposed to exult in the uninterrupted prosperity of their prolific community, and the pellucid medium by which they were surrounded. In all the other masses, or communities, some of the accidents to which the hydatid existence is subjected, were illustrated and proved.

In the small inferior cyst, placed behind the cyst of which I have just spoken, we found the parent hydatid separated from the cavity, that cavity contracted, and the hydatids crushed by the diminution of the cavity, and exposed to the influence of the absorbents of the body.

In the large superior cyst, the hydatids had apparently multiplied till they had perished for want of space: the parent cyst had died, the cavity suppurated, and the few hydatids which remained entire were floating in a mixture of pus and the decomposing *débris* of other hydatids: and here, likewise, the absorbents seemed to have been distended by the fluid of the cyst, and probably impeded in their action.

In the fourth cavity, the secretion of the liver had insinuated itself behind the parent cyst, destroyed its vitality, forced it from its situation, and, mingling with its contents, proved a source of death and destruction to the greater part of the hydatids it contained. Thus, as I have said, does this single case illustrate many of the most important epochs and accidents which mark the progress of the hydatid.

The following case I find already detailed, somewhat at length, in the excellent volume of Lectures lately published by my friend Dr. Hodgkin, who has selected it as a very illustrative example of the extent to which this affection occasionally goes: but as I had this patient frequently under my care, and was of course greatly interested in the post-mortem appearances, which afforded several varieties and

modifications, I shall not hesitate to give a pretty full abstract of the notes I took at the time; though they may appear more minute than absolutely necessary for the elucidation of the subject.

CASE 2.

Hydatids extensively occupying the Abdomen.

EDWARD CULLUM, aged 26, a dyer by trade, admitted Feb. 22d, 1826. — Has a large, firm, elastic tumor of the abdomen, which projects abruptly from the hypochondria, and soon attains its largest circumference, which, at present, measures forty-three inches, afterwards tapering downwards to about forty inches. It is not tender on pressure, and, when grasped, presents an irregular knotted surface, both above and below a margin which crosses the umbilicus, and seems to be that of the liver. The integuments of the abdomen exhibit a number of enlarged veins, running upwards; but are otherwise healthy. With this tumor he has considerable dyspnœa and cough. An attempt to lie on the back, or on the left side, is attended with a sense of suffocation: in consequence of which, he either sits during the night, or reclines on the right side. He sleeps ill, is somewhat emaciated, complains of much weakness, and, towards evening, has a little œdema of the legs. Pulse 20, quick, and rather irregular: respiration 28, chiefly thoracic, and attended with some effort and wheezing. On percussion, the chest everywhere sounds well, except on the right side; throughout the lower half of which the sound is dull. Examined by the stethoscope, the respiration in the same region is inaudible, as likewise in the lowest part of the left side; but in other parts of the chest, natural. The complexion is pale; conjunctiva slightly tinged, and injected; tongue white and clammy, with reddish edges: some thirst, and little appetite: much flatulence. Small quantities of light animal food, with bread, agree best; but vegetables, liquids, or a large quantity of any thing taken at a time, inflates and oppresses the stomach. The bowels are inclined to costiveness, which increases the dyspnœa. Urine reported to be scanty, high-coloured, and occasionally turbid. He can assign no other

cause for his complaint than pressure of the abdomen on the edges of the vats used in dying; which, at an earlier period, apparently induced hernia in each groin. The abdominal tumor commenced, nearly three years ago, in the right hypochondrium, and has gradually grown to its present size, with the addition of the symptoms above described. He has been repeatedly a patient in Guy's; and was last week dismissed, after a year's residence in Luke's Ward; since which, the dyspnœa, cough, and flatulence have increased, and he is therefore again admitted into the hospital.

The daily observations, which were carefully made till the 16th of March, when he died, confirmed what has been already stated. The respiration was frequently embarrassed, more at one time than another, but was performed about 28 times in the minute. The pulse not unfrequently intermitted very much, and was irregular; sometimes varying, in the course of a few minutes, from 58 to 120; at other times small, weak, and indistinct, having the second beat sometimes nearly lost. The urine was scanty, high-coloured, and very turbid; and on one occasion, of a deep mahogany colour, with a pinkish sediment, as if tinged by the purpures. The bowels required to be frequently assisted in their action, by purgatives; but the evacuations were often natural, and only on one or two occasions, and for a short time, deficient in bile. His legs, which had occasionally before been œdematous, became very much so a few days after his admission, and continued in that state as long as he survived.

SECTIO CADAVERIS: March 17th, 1826.—Face purple: veins of neck distended: abdomen covered with marks of a network of veins, but not so much enlarged as in many cases of pressure on the cava: a great many parts of the body and thighs quite purple or lilac, as in one who has died a violent death: abdomen much distended, with the same knotty feel as during life.

On opening the abdomen, the liver was seen descending much lower than natural, having afforded that evident margin which was perceptible during life. Almost the whole lower

part of the abdomen was full of rounded bodies, of the size of moderate potatoes, partially covered or intermixed with omentum, the vessels of which ramified over their surface. The small intestines were seen in the left iliac region, occupying a very small space of the whole. A large dark-coloured body was seen above them, in the left side, which looked at first like diseased spleen. On further examination, it appeared that the whole of this morbid mass was a collection of hydatids, situated in the omentum, to which they were attached, and seemed as if entangled amongst the meshes of a net. (Plate V.) The dark body on the left side was another of these hydatids, as large as the largest orange, casually coloured, apparently by blood, of a darker or blacker tint. The liver, though to appearance so much enlarged, was, in fact, not at all larger than usual; but was filled with hydatid cysts, some of which held at least a pint of the most limpid fluid imaginable, as pure as distilled water; and the substance of the liver was, in some parts, attenuated like a membrane. One very large hydatid occupied the right hypochondrium, and entered the substance of the liver; and one, situated just above the gall-bladder, and capable of containing at least half a pint, seemed to have opened into a biliary duct, so that it was full of a turbid yellow fluid, bearing so much the character of bile, that at first it was supposed to be the distended gall-bladder: however, on further observation, it appeared that this had been filled by one large hydatid, completely discoloured by the bile; and that the surface, from which this cyst had been detached, was scabrous and uneven, and of a dark-green colour, with black and yellow intermixed. The gall-bladder itself was found quite healthy, and not communicating with any preternatural cavity, but rather compressed by the surrounding hydatids. The semi-transparent or opalescent hydatid cysts which lined the cavities formed in the liver were very easily detached; and left a yellow semi-membranous pouch in the liver itself, quite incapable of being separated from the substance of the organ.

The cysts were most of them filled with other hydatids, almost all fully distended, floating in more or less water. In some of the cysts there were no hydatids of any size

larger than millet-seeds, which either floated, almost like dust, in the water, or were attached, as frost, to the large hydatid cyst. Some of the hydatids in the omentum were much thicker than others; and, in general, the thickest appeared to contain the greater number of hydatids within them: some were completely filled; and, when opened, poured forth one mass of globules, from the size of small shot to small marbles, only differing in degrees of transparency, scarcely at all in colour, except that some were quite transparent, some of an opake white.

These numerous large cysts had forced the liver, forming one, as it did, with the cysts, very high up towards the thorax; so that the lungs only extended half way between the third and fourth ribs on the right side. In attempting to remove the liver by cutting through the diaphragm, two or three large hydatid cavities were opened. It is almost impossible to describe how the different cysts were placed in the abdomen. The spleen was surrounded and occupied, like the liver, with hydatid cysts, of the size of large oranges: two or three others had pressed upon the kidneys, particularly on the right one, so as to have completely deformed it, and produced some absorption: but, on the whole, the kidneys were rather large, and were quite healthy in structure. There were several small yellow calculi in the right; and the ureter of the left was distended, from the pressure of hydatids.

The pelvis was quite filled by two or three large hydatids, appended externally to the bladder.

The stomach was congested; and an hydatid of the size of an egg, not far from the pylorus, seemed as if it would have burst very shortly into the stomach. The small intestines were congested, but otherwise healthy. The colon was very much involved in the hydatids lying on every side in the omentum, but was itself quite healthy. The mesentery was altogether free from even any attached hydatids. The glands were slightly enlarged.

The lungs perfectly natural, but diminished in size: a few dilated air-vessels on the thin margin: on both sides exceedingly restricted for room;—on the right by the liver; and on the left still more, by projections from the abdominal

contents, and by the heart being much enlarged (probably nearly twice the natural size, but healthy in valves and structure). The lungs on neither side diseased.

The hydatids which lined the sacs in the liver and the spleen were rather opaque, as thick as wash-leather; and were very easily detached from the cavity in which they were contained, being scarcely united, except by close apposition: yet their external surface, on being pulled out, was slightly shredded with lymph-like, transparent membrane. They tore easily; and had a strong tendency to curl up, whenever torn through; so that it was difficult to spread them out. Internally, they were slightly and pretty evenly granulated, on every part: and in a large one, taken from the liver, a space about the size of a sixpence was very curiously marked with raised rugæ, forming semi-transparent waved lines; while in others, both small and large, irregular, but somewhat circular spots were, in two or three instances, seen, of the brightest white colour, studded with white tubercles, of the size of pins' heads (Plate IV. Fig. 6.): and in a parent hydatid, lining a large cavity in the spleen, was a very singular mass of jelly-like substance, attached to the internal surface, and looking as if it were composed of a multiplicity of irregular transparent bodies, of the size of mustard-seeds, or larger, stuck together so as partially to conceal their individual forms. Of this I procured a drawing (Plate IV. Fig. 7.);—and I observe, that Dr. Hodgkin, speaking of this case, seems to consider these anomalous appearances in the light of diseases of the hydatids.

In the foregoing case, the disease had certainly existed for several years; having begun, in all probability, in the liver; from which, at some unknown period, the hydatids had escaped into the cavity of the abdomen. The patient had distinctly observed the tumor in the right hypochondrium above three years before his death. The immediate cause of death, in this case, was probably connected with the very insufficient state of nourishment, which was the result of the pressure of the hydatids, and their encroachment on the various organs of the abdomen; while the dilated condition of the

heart favoured the tendency to internal congestion, and hastened death.

CASE 3.

Hydatids developed in the Abdomen.—Death from Peritonitis.

THOMAS DAWSON was admitted, when at the age of 14, into Guy's Hospital, in June 1828;—a slight-made boy, marked with the small-pox, the eldest of five children, of a very poor family in the Borough. The account he gave of himself, as to the duration of his complaint, was not very satisfactory; for he stated, that he had observed nothing wrong about his abdomen till nine weeks previous to his admission, when he perceived a hard lump in the right side below the false ribs; and since that, his abdomen had swollen to its present state. It was greatly enlarged; and over the whole might be felt, from the scrobiculus cordis to the pubes, a number of round bodies, some of the size of walnuts, and others of large eggs, elastic to the feel, and scarcely leaving a doubt on our minds that they were of the hydatid character. In some instances, the projections occasioned by these bodies were sufficiently obvious to the eye; and a sketch, which was taken for me, by Mr. Canton, at the time, will give a very fair idea of the appearance the abdomen presented, as the boy lay, inclining to the right side, on his bed. (See Plate VI.) His general aspect was not unhealthy, except from a certain degree of emaciation: his teeth were unusually white and regular, and his tongue clean. He experienced little or no uneasiness, when pressure was made on any part of his abdomen. He remained in the hospital several months, during which time he was generally able to go into the court-yard to walk; but suffered two or three febrile attacks, on which occasions his tongue became coated, his pulse accelerated, and the abdomen tender on pressure. On the whole, however, very little change took place, except in the gradual enlargement of the abdomen, and the general emaciation. He left the hospital after several months, and returned to his family. From that time he continued to be subject to all the hardships and irregularities to which his situation necessarily exposed him, and was chiefly employed in selling fish about the streets: in which occupation I fre-

quently saw him, poor and miserable, but by no means so deficient in activity as might have been expected from his bulk.

On October 5th, 1836, he applied to be again admitted into the hospital. His symptoms were, at that time, those of an acute but neglected attack of peritonitis, accompanied probably by effusion into the abdomen. The fluctuation, however, was very indistinct, and the tenderness such as to preclude a very minute examination. The general size of the abdomen was greatly increased, and the surface was marked by numerous superficial veins. The lobulated form of the abdomen corresponded with the idea previously formed, that the disease depended on hydatids; but the rounded bodies were larger, and by no means so well defined, or so elastic, as they had been eight years previously. In two or three parts, projections were obvious to the eye; and I had no doubt that one corresponded with a very prominent projection in the sketch taken on the former occasion; allowance being made for the greatly-increased bulk, and consequent pushing upwards, of the whole mass. The enlargement of the abdomen had produced great dyspnoea, by the singular encroachment which had been gradually made upon the chest, as will be distinctly seen in the sketch made by Mr. Canton on this occasion. (See Plate VII.) He survived in this state but a few days, and died on the 15th of October.

SECTIO CADAVERIS.—The abdomen was enormously enlarged, encroaching upon the thorax. In one part only, of small extent, was any clear or tympanitic sound elicited on percussion; and this was in the umbilical region, towards the left side, and in the left lumbar region. All the rest of the abdomen felt solid and lobulated, only slightly elastic, and was perfectly dull on percussion. The parietes adhered closely to every part of the contents of the abdomen, so that it was difficult to detach them; and one or two slight punctures of the colon could not be avoided. When the integuments were at length carefully dissected off (Plate VIII.), the whole, except the parts where the tympanitic sound had been elicited, proved to be one mass of cysts, covered with

a firm dense membrane; which so closely bound them down, that it looked like a large lobulated mass, rather than a collection of cysts. On opening the cysts, some of them were found to contain a solitary hydatid, having no others within it; while the greater part were full of small hydatids, presenting all the forms and peculiarities which are ever observable, and which have already been minutely described in the foregoing cases. In general, it might be remarked, that the skin and *débris* of the hydatids, which, by compression, had lost their vitality, bore a large proportion to those which were entire, spherical, and transparent. One particular cyst, which had been distinctly felt on the outside, and had been obvious to the eye, (and which I considered the same that I had observed and figured in the sketch made eight years before,) contained a perfectly isolated hydatid, which formed the lining membrane of the cyst, and was filled with the most pellucid fluid. A very large cyst occupied the upper portion of the liver, and was full of hydatids, of different sizes, and in various states; and another very large one, apparently communicating with the gall-bladder, was filled with a congeries of hundreds of small hydatids, and innumerable broken fragments, with a large quantity of soft, broken-down biliary concretions; the whole of the contents being deeply stained with bile. One cyst encroached upon, and was insinuated into, the substance of the spleen; while a few smaller hydatids had apparently found their way amongst the fibres of the diaphragm, and occupied the lower part of the mediastinum.

The kidneys were healthy in structure; but the right was in a great degree absorbed, owing to the excessively distended state of its pelvis caused by the obstruction of the ureter. The bladder contained about half a pint of urine. The small intestines were found occupying the central part of the diseased mass: they had evidently been the seat of recent peritonitis; for wherever former chronic disease had left them free, which was over a large part of their extent, they were now connected together by long bands of yellow friable lymph: there were also many flocculent tufts of fibrinous matter hanging about these portions of the peritoneum, the evident remains of former inflammation. The

lungs were most exceedingly compressed; for the contents of the abdomen actually reached the second rib.

In this case, then, we have a distinct history of the disease having existed, in its most characteristic form, for a period little short of ten years; during which time, comparatively, little general derangement had been experienced: indeed, under the most unfavourable circumstances, this young man had continued to perform the avocations of life, with some interruptions, till within a few months of his death.

It seems probable, from all that can be gathered in this case, that the first development of the hydatids was in connection with the liver; that for a period of considerable, though uncertain, duration the disease had been quite unobserved; and perhaps the attention was first called to its existence when some escape had taken place from the original seat, and probably the inflammatory action thus set up had produced the illness for which he first sought admission into the hospital. The hydatids, escaping from their original seat, soon enlarged, so as to be plainly felt, over the whole abdomen, as round well-defined elastic tumors; although he clearly stated, that nine weeks previously he had discerned nothing but the enlargement in the right hypochondrium. The hydatids, thus poured out, became fixed, by inflammation, in the various parts of the abdomen where they first lodged; and according as they were single, or capable of multiplication, they remained either like simple sacs—as in one case, on the right side of the abdomen, was very well marked; or they became the source of those congeries of hydatids which were found in several parts; and the whole of them, owing to the repeated processes of inflammatory action to which they had given rise in the omentum and peritoneum, had changed their distinct elastic character for the more hard lobulated botryoidal substance discoverable by examination on his last admission. It was quite evident, that the immediate cause of death was an extensive, but accidental, inflammation of the peritoneum, chiefly in those parts, amidst the convolutions of the small intestines, which had escaped the effects

of chronic attacks, and the gluing of adhesive inflammation: but it is very greatly to be doubted, whether the disease, in this case, had not advanced almost to its natural or necessary termination; seeing that it had already greatly encroached upon the thorax, and compressed the lungs to such a degree, that certainly these organs were no longer able to admit one-fourth of the air requisite for the healthful discharge of the function of respiration.

There is one point deserving of remark in this and the two preceding cases. In each of them, but particularly the two last, it would appear probable, as I have said, that the hydatids were, at first, confined to the liver, but that, from some cause, they became diffused into the abdominal cavity: and yet it is observable, that none of these bodies seem to have effected a lodgment, or to have been developed, amongst the duplications of the mesentery and the convolutions of the intestines: and thus they have offered, comparatively, little interference to the peristaltic motions, and the general functions of the alimentary canal. It is probable that the immediate cause of this immunity is the close apposition of the convolutions, and the tendency which the intestinal motions may have to propel the little bodies forward; but in the pelvis, particularly behind the bladder, where a good opportunity of lodgment is afforded, we often meet with the hydatid cysts.

CASE 4.

Tumor of the Abdomen supposed to depend on the presence of Hydatids.

— ENGLISH, aged 42, a weaver, was admitted into the Hospital, April 4th, 1832, on account of a great enlargement of the abdomen, under the care of Dr. Back, who afforded me an opportunity of examining the tumor very carefully. It appeared that the swelling was of a very irregular character, occupying the upper part of the abdomen; and that just below each hypochondrium, a round, soft, and elastic projection was discoverable. The projection on the right side was the larger, and proceeded from immediately below the margin of the ribs; and though it could not be traced decidedly under them, might well be supposed to arise from

the liver. According to the statement of the patient, these two had been preceded by one or two nearer to the centre, and towards the umbilicus, which had appeared to disperse, and move a little more to the right: but statements of this kind are always so doubtful, that little confidence can be placed in them. There was an umbilical hernia, of the size of a small egg; and several enlarged subcutaneous veins were seen passing longitudinally up the abdomen. In a sketch I made, a line, passing somewhat irregularly across the body, half way between the umbilicus and the pubes, had the whole tumor above it. He stated, that, occasionally, when he neglected his bowels, his ancles swelled; but otherwise, they did not. The motions were rather pale, and the urine high coloured. His own statement of the progress of the disease was, that about six years before he had a severe illness, which he believed to be scarlatina; and at that time his abdomen was enlarged. After about three months of active treatment, he became better; and though never quite well, he continued in tolerable health till three years ago, when his abdomen swelled; and a year after, he first perceived the unequal tumors of which the swelling is now composed. He has never been decidedly ill in his feelings, nor has he been jaundiced. His eyes are clear and bright, and he has no pain on pressure of the abdomen; but the enlargement is such as to prevent his getting into the loom, on which he has always depended for his livelihood.

The extent of this irregular and lobulated tumescence, its being almost confined to the upper part of the abdomen, and the absence of that obvious fluctuation which could not fail to be present were so large an increase of the size to depend on fluid, distinguished this case from ascites; and its slow progress, together with the alightness of the constitutional derangement, rendered it very improbable that it should be malignant growth. The inference therefore is, that it is a case of hydatids, which has now been at least three years in its progress.

CASE 5.

Hydatid Cyst connected with the Liver. Death from suppuration of the sac and its consequences.

SARAH TURNER, aged 42, admitted into Guy's Hospital, March 25, 1829, rather a bulky woman, with a dark sallow complexion. She states, that, during the last twelve years, she has been at least twelve times the subject of jaundice;—that about six weeks ago she became again suddenly jaundiced; and continued so for ten days, the stools being perfectly white, and the urine bilious. Three weeks ago, when the jaundice had gone off, she suffered a severe rigor, of four hours' continuance; and has not since recovered. At present, her pulse is 84, and sharp; tongue moist, but covered with a brown fur. There is great appearance of prostration; the bowels are relaxed, and the stools of a very dark colour. There is a tumor at the pit of the stomach, extending almost to the umbilicus, tender on pressure, elastic to the feel, and appearing to have a solid base. This tumor she says has been observed for three or four years, appearing larger or smaller, according to the degree of distention of the stomach..

The symptoms went on increasing; the sickness became more urgent; the tongue more dry, and red at the edges; the abdomen more tender. On the 30th, she passed blood, by stool, two or three times; and falling into a state of insensibility, remained so about twenty-four hours, when she died.

SECTIO CADAVERIS.—The tumor was very evident, projecting at the scrobiculus cordis. There was a considerable accumulation of yellow adipose matter in the integuments. The parietes of the abdomen were attached very firmly, by old adhesions, to the tumor, which occupied chiefly the right lobe of the liver: the tumor was of a membranous appearance, and vascular; and contained nearly a washhand-basin-full of hydatids, of all sizes, from that of a French walnut to a pea, but chiefly of about the size of a hazel-nut. The greater number were burst, and opaque; but many retained their globular form. The fluid in which they were closely impacted was puriform; and the parietes of the large cavity were lined internally with a layer of thick pus-like matter, with

shreds, and cakes of a cheesy substance, adhering closely. The cyst itself, owing to the suppuration that was going on, had assumed a worm-eaten appearance.

The liver seemed healthy; but was thrown out of its shape by the large cyst, which had likewise encroached upon the thorax. The gall-bladder contained about an ounce and a half of yellow fluid, almost entirely mucus, with a slight bilious tinge. The whole peritoneal surface of the abdomen shewed marks of severe recent inflammation, having on it shreds of yellow lymph, and a considerable quantity of puriform serum. The intestines were highly vascular.

With regard to the hydatids themselves, they differed in no respect from what have been already described: many of them had a number of small ones within them; and some of them presented that peculiar appearance of the inner surface which resembles a heap of transparent granulations, arising from their inner surface, such as is represented in Plate IV. Fig. 7.

In this case, there can be no doubt that the irritation produced in the system by the unhealthy suppuration going on in the cyst, and, afterwards, the more diffused inflammation of the peritoneum, were the immediate causes of death. The strong adhesions which subsisted between the cyst and the parietes suggest the probability that, had this cavity been evacuated by an operation before the inflammation had been set up, the result might possibly have been favourable. But the time when such an operation could have been useful must have been long antecedent to her admission into the hospital; before her system had suffered from the slow suppuration of the sac; and still more, before this general peritoneal inflammation was set up, which, from the actively vascular appearance of the tumor, was, no doubt, a consequence of the local disease.

CASE 6.

Hydatid Cysts in the Liver ossified.

LYDIA SEABALD was admitted into Guy's Hospital, Oct. 8th, 1813, labouring under slight jaundice and mania. It appeared that constipation of her bowels, attended with sick-

ness and pain, had occurred about ten days before; and that two or three days after, jaundice came on, with occasional derangement of the intellect, which had been constant for the last two days. She frequently lay in a state of insensibility, approaching to coma; at other times she was raving in mania: her motions were very dark. She died on the 16th.

The liver was found to contain hydatid cysts; of which one, about the size of an orange, was completely ossified, throughout more than half its extent; and there were two or three smaller ones imbedded in the liver, which were not larger than a pea, but were also ossified; and all of them were filled with the remnants of hydatids, pressed together; and, in some parts, the convoluted laminæ were capable of being separated and unrolled. The dura mater was, in this case, spotted over its whole internal surface with a great number of bloody points, from ruptured vessels.

In each of the two following cases, the only hydatid cyst which was discovered had developed itself in the space between the bladder and the rectum.

CASE 7.

Tumor in the Pubic Region from an Hydatid Cyst situated behind the Bladder.

W. SKINGSLEY, aged 54, was admitted into Guy's Hospital, labouring under serous effusion, with dyspnœa, and coagulable urine. He died, after remaining in the hospital some weeks: and, on examining the body, a tumor was found, about the size of a very large orange, situated between the bladder and the rectum, so that it had pushed the bladder forwards, and, together with the bladder, presented a projection which was quite obvious before the abdomen was laid open. This proved to be a cyst, containing a number of hydatids about the size of marbles, and smaller, with a large collection of the broken remnants of other hydatids. The cyst was, in some parts, nearly a quarter of an inch in thickness; and, internally, many patches of bony matter had been deposited: grasped in the hand, it gave, when emptied, the elastic feel of an Indian-rubber bottle. The mucous membrane of the

bladder was quite free from any inflammation. The rectum was a little irritated. The kidneys were rather small, their tunics adhered firmly, their external surface was coarse and granulated, and they were not easily broken down by pressure.

Another case had previously come to my knowledge, of a very similar character: and as I was present at the post-mortem examination, and I believe the preparation is in the Museum at Guy's, I will state the facts nearly as I collected them.

CASE 8.

Tumor in the Pubic Region from an Hydatid Cyst situated behind the Bladder.

THE patient, who had been labouring under other disease, complained of the difficulty he had in retaining his water: and, when an examination was made, it appeared that the urine was continually passing away, and that a tumor, bearing all the characteristics of a distended bladder, presented itself at the pubic region. This at once suggested the idea that the patient was suffering from retention of urine, produced by enlarged prostate, or some such mechanical cause. A catheter was introduced by a skilful surgeon; and a few drams of perfectly healthy urine drawn off, without producing any diminution in the bulk of the tumor. As it was still supposed that urine was retained, more than one medical man attempted to draw it off; and at length the catheter became obstructed by the passing of small hydatids. When this was discovered, a sucking-pump was applied to the catheter, and thus a considerable quantity of the *débris* of hydatids was removed: however, the symptoms of this disease remained, his other complaints increased, and ultimately the patient died.

SECTIO CADAVERIS.—The tumor, which appeared, on opening the body, filling the whole pubic region, proved to be a large hydatid cyst, attached to the posterior part and the fundus of the bladder, and pressing so much forwards as to prevent entirely the bladder from being filled with urine; and this was the source at once of the tumor and of the

constant escape of urine. The bladder itself was quite healthy; nor had the catheter passed through it to reach the hydatid cyst, but, on the contrary, had passed by an opening from the urethra behind the bladder. The cyst which contained the hydatids was, in some parts, about one-sixth of an inch in thickness, and irregularly converted into a cartilaginous substance, with a rough internal surface. It contained, at least, a quart of the shreds of burst hydatids; with a few of the size of small marbles, which were quite perfect, and transparent; the whole contents being of the thickness and consistence of a paste. The tumor made pressure on the orifices of both the ureters, which were consequently very much distended with urine; and the pressure which had been made upon the kidneys by the fulness of the pelves had produced a very extensive absorption of the substance of both. The fluid contained in the ureters was puriform, and there were some small clots of blood in the infundibula.

In cases of so doubtful a kind, we might derive diagnostic marks from the history of the tumor, if the patient had sufficient intelligence to assist us in the inquiry: so likewise from the feel of it, which would probably be harder or less regular than of the bladder; but on this no perfect reliance could be placed. The character of the urine which is drawn off would be almost sufficient to decide the question: for if the urine be retained any time in the bladder, it generally acquires a much darker hue; and all its sensible properties at once bespeak that it has been long secreted, and concentrated or altered by retention.

CASE 9.

Hydatid Cyst connected with the Liver, emptied by Paracentesis.

M— H— was admitted into Guy's Hospital with a large fluctuating tumor of the abdomen, occupying, apparently, almost the whole cavity. As she suffered much, both from constitutional irritation and from the pressure of this tumor, Dr. Cholmely, whose patient she was, thought it right to draw off the fluid by tapping; and a very large quantity of purulent fluid, mingled with

shreds and portions of hydatids, came away. It was now discovered that she was pregnant; a circumstance which she had concealed. By perfect quiet, she recovered somewhat after the operation, but, after two or three weeks, miscarried. Her bowels became obstinately costive, she had frequent vomiting, became deeply jaundiced, was unable to take any food, and died completely exhausted.

SECTIO CADAVERIS.—A large cyst was found arising from the liver, descending quite to the pubes, adhering to the parietes of the abdomen on the whole of the right side, and making pressure on the kidney. This cyst arose as high as the diaphragm; and had pushed all the intestines back into the left lumbar and iliac spaces, so that they did not occupy one-third of the abdominal cavity: the stomach had likewise been completely displaced, by its pressure. This cyst still contained about three pints of greenish-yellow pus, and a large quantity of the skins and remains of hydatids; but not one could be found in its entire or globular form. The cyst itself, which was of considerable thickness, was internally undergoing a process of suppurative softening, and was pulpy and irregular on its surface. The upper part of it near the diaphragm, where it seemed to have originated in the substance of the liver, contained a curd-like matter, almost cheesy in its consistence, apparently a mass of fibrine, pus, and the shreds of hydatids.

Exactly in the seat of a femoral hernia there was a small tumor, of the size of two large marbles; which proved to be a cyst, containing a number of hydatids.

The liver was soft throughout; and the left lobe very large, extending far towards the left side. The gall-bladder was much distended with bright green bile; and the obstruction to the passage down the ducts had probably been the cause of the deep jaundice which had occurred before death. The right kidney was, to a great extent, absorbed by the pressure of the tumor; and the pelvis much enlarged, containing some calculi. The left kidney was unusually large. The uterus was large, and imperfectly contracted: the ovaries were unhealthy, with vesicles.

In this case, I am unable to say how long the disease had existed; but there could be no doubt, from the great extent of the cyst, and what we know of the general progress of such cases, that many years had elapsed; and as it had gradually encroached upon the right lobe of the liver and the right kidney, it was curious to observe the apparent compensation which had been established by the unusual increase of the left lobe of the liver and of the left kidney. In this case, the inflammation and suppuration set up in the cyst seems to have been quite destructive of the organization and the vitality of the hydatids, none of which were found in their globular and unbroken state.

CASE 10.

Hydatid connected with the Liver emptied, by Paracentesis, with success.

A YOUNG WOMAN was admitted into Guy's Hospital, in December 1828, under the care of Mr. Key, with an elastic swelling occupying almost the whole scrobiculus cordis, and inclining rather to the left side: it was not the least discoloured, and gave an evident sense of fluctuation. The swelling was divided into two lobes, of which that to the left was the largest; and the fluid seemed to pass from one to the other. Her health did not suffer; but, of late, the tumor had become rather painful, and, by its bulk, had interfered considerably with her comfort, having enlarged much more rapidly than when first perceived. She had been in the hospital two years before, when Mr. Key attempted without success to make an opening gradually by a caustic issue: he now thought it right to employ a small trochar; and, accordingly, on the 22d of December, four pints of a perfectly limpid fluid, with little or no smell, nor any appearance of lymph, shreds, or flocculent matter, were drawn off. The operation afforded her great ease, and was followed by no symptoms of inflammation. For a time, the cyst appeared to fill gradually; she lost her colour, and had frequent tendency to faint; and afterwards a little diarrhoea came on, which, however, was easily checked.

Feb. 5. The tumor, though it has not entirely disappeared, is much less than before the operation, and presents

no unequal or lobulated swelling, as it formerly did; but gives a slight appearance of fulness to the scrobiculus cordis.

Towards the end of the month she left the hospital: and I have heard from Mr. Key, within these few days, that she remains perfectly well, has since married, and enjoys excellent health, without any re-accumulation having taken place.

I examined the fluid very carefully, by means of Dr. Roget's microscope; but could detect nothing like minute hydatids, or other foreign matter. Mr. Key also allowed me to put a portion of it into the hands of Dr. Bostock, who was kind enough to undertake its analysis; and I shall give the communication I received from him a few days ago; observing, that, in one point, his account differs from what I find stated in my notes; the fluid having apparently lost a little of its pure and limpid character, when he undertook the investigation.

" MY DEAR SIR,

" I have revised my note-book, which contains the account of the experiments that were performed on the fluid from the hydatid, in December 1828; and I have extracted what appear to be the most remarkable or characteristic circumstances respecting it. If you require any further explanation, on any of the points connected with the experiments, I shall be most happy to furnish you with it, as far as lies in my power.

" Most truly yours,

" Putney Heath, Aug. 28th, 1837.

" J. BOSTOCK.

" The fluid was homogeneous, somewhat opaque, of a light brown colour: it had a slight but peculiar acrid odour, and a specific gravity of 1008. It scarcely affected the most delicate test-papers; the uncombined alkali, if any, being in so minute a quantity, that one part of the acetic acid of the Pharmacopœia, added to 100 parts of the fluid, caused it to redden litmus. There was, however, a perceptible, although very slight indication of alkalescence, when it was evaporated to one-tenth of its bulk: a portion of it, also, became slightly alkaline, after being exposed for about three weeks to the atmosphere: at the same time, it had acquired a sharp acrid

odour, and was covered with a very thin brown film: the fluid was somewhat more opaque and coloured, but there was no sediment. It was not affected by the boiling temperature; and the re-agents for albumen indicated the presence of this substance in a minute quantity only. When evaporated by a heat not exceeding 150°, a residuum was obtained of 1.25 per cent., which evidently consisted, for the most part, of muriate of soda. Along with this there was a portion of an animal substance; which was soluble both in water and in alcohol, and which I should characterize as nearly related to the substance which forms the specific ingredient in the serosity of the blood. There were also indications of the presence of sulphuric acid and potash, but each of them in very minute quantity. No lime could be detected in it. It appears, therefore, that this fluid exhibited some decided peculiarities, when compared with other fluids which may be presumed to have a similar origin:—1. The absence, or at least the very minute quantity of uncombined alkali. 2. The small quantity of albumen, compared with the total amount of solid contents. 3. The presence of a considerable quantity of extractive matter; and, 4. The large proportion of the muriate of soda which it contained. The composition of the fluid may be estimated as follows, in 1000 parts:—

| | |
|---|---------|
| “ Water | 987.5 |
| Extractive, with a trace of albumen | 4 |
| Muriate of soda, with minute quantities of sulphuric acid and potash | 8.5 |
| | <hr/> |
| | 1000.0” |

CASE 11.

Hydatids in the Spleen bursting into the Abdomen, and causing death very speedily.

IN the month of February 1821, a patient in Guy's Hospital, who had been under the care of Dr. Back, with obvious hepatic derangement, and a large tumor in the abdomen; became suddenly most alarmingly ill, and died within half an hour. On a post-mortem examination, it appeared that the immediate cause of death was the bursting of a large hydatid in the spleen, by which at least a pint of limpid fluid had been effused into the abdomen. The appearance

of this large hydatid was rather peculiar; as it entered so much into the substance of the spleen, that over nearly half the cyst that viscus formed an external coat, gradually dying away into a tough leather-like substance, which formed the more protruding part of the membrane covering the hydatid, and which, in the present case, seemed to consist of a thickened portion of the peritoneum. Within this was situated the true hydatid cyst, like a lining of soft leather, having its external surface marked by numerous projections, which fitted into little cavities in the spleen;—an appearance which probably depended on the cellular structure of the viscus which the hydatid occupied. The internal surface was smooth, as if covered with a thin transparent membrane. In the liver there was an hydatid, of the same size as that of the spleen; and there were smaller cysts in the kidneys. These hydatids were, as far as I remember—and the notes I made at the time do not contradict it—each formed of a single unproductive cyst.

CASE 12.

Hydatid of the Liver, suppurating and bursting into the Abdomen, causing immediate death.

IN the year 1813, when I was attending the practice of the Bishop's-Court Dispensary, a very interesting case occurred, the hydatids taken from which I had a long time in my possession. Not being able to find the notes which I took on the occasion, I have applied to my excellent friend Dr. Laird, who during many years discharged the duties of physician to the Institution at which the case occurred, and those of physician to Guy's Hospital, with singular diligence and success: and I shall give the case in his own words.

"Bognor, August 30, 1837.

"I perfectly remember the patient to whose case you refer; and the interest you took in the examination, which you had the kindness to undertake at my request. But I think his death must have occurred in 1813; rather than in 1814, as you suppose.

"The patient was about five or six-and-twenty years of age, and was employed in the shop of Messrs. Laurie and

Whittle, the mapsellers in Fleet Street, contiguous to whose premises he had fixed himself, on the west side of Fetter Lane. He suffered under obvious inflammation of the liver, attended with jaundice, indicating that the parenchymatous substance of the liver was affected. He was, at first, so much benefited by what was done for him, that I hoped a favourable issue in the case; but a visit which he most imprudently made to some friends at Vauxhall was immediately followed by a sad aggravation of his complaint; which then rapidly passed to its fatal termination in a few weeks, not more than two or three, to the best of my recollection. His death took place suddenly, on his getting out of bed: and I was the more anxious to know the immediate cause of death, because I had previously found, by a post-mortem examination, that the bursting of hepatic abscess had been followed by immediate failure of the vital energies. You will doubtless remember, in our Dispensary Case, that you were obliged to remove much purulent effusion from between the folds of the intestines, I think to the amount of two or three pints, in order to follow your inquiry; and that a great number of small hydatids were found floating in the fluid. The source of this effusion you found in a ruptured cyst on the convex surface of the right lobe, the capacity of which must have been very great. In the left lobe there were several small independent abscesses; but I do not remember any appearance of hydatid origin in them. There was no appearance of recent inflammation in the peritoneum, death having so quickly followed the rupture of the cyst; and the other viscera of the abdomen were, I think, in a healthy condition, as were those of the thorax."

In these two cases, we find the sudden rupture of an hydatid cyst causing immediate death. There is every reason to believe, as I have before stated, that, under certain circumstances, the rupture of the cyst, and the escape of the hydatid into the abdominal cavity, is not followed by a fatal result: but where it happens suddenly, and by a large opening, we cannot but apprehend, either immediate death, or the occurrence of peritoneal inflammation. It is, how-

ever, no doubt, where suppuration has already gone on within the cyst, as in the last case, that we are to expect the more dangerous effects, both from the previous state of the constitution, and from the condition of the part, as well as from the more irritating character of the fluid thrown into the abdominal cavity. In the following case, it is believed that a large cyst burst suddenly into the abdomen, without being followed by a fatal result.

CASE 13.

Supposed Hydatid of the Liver bursting into the Cavity of the Abdomen.

June 13, 1836. — — —, a boy of 14 years of age, was admitted into Barnabas Ward, under Dr. Addison, with the chest quite deformed by the protrusion of the lower ribs of the right side; but more particularly by the entire displacement of the false ribs, affording a sense of elasticity, and almost of fluctuation in that part. At the same time, the liver was pushed below its usual position, so that its margin was to be felt far down in the abdomen, below the umbilicus.

It appeared most probable, from the projecting form of the tumor—from the way in which the false ribs were raised, and the degree in which, at the same time, the liver was pushed down, while the respiration was quite natural on that side of the chest—that the disease was situated below the diaphragm. At the same time, the absence of many symptoms, and the want of any decided tendency to jaundice, led to a belief that it was not an abscess of the liver; and it was therefore inferred as highly probable that the enlargement arose from an hydatid cyst situated in the convex surface of that organ.

His condition scarcely underwent any change while he remained in the hospital; and, after staying about a couple of months, he left it, and returned to his friends, who were in circumstances to maintain him comfortably. In the latter part of August he suffered from hæmorrhage, after having a tooth drawn; and while recovering from this, in the beginning of October, he was attacked with severe pain in the swelling of the right side, and was very ill for several days;

but recovered from that attack: and in the middle of the same month he applied as an out-patient at the hospital. Till the 25th of October the fluctuation remained the same, and the swelling increased a little; but on rising from his bed on that morning, he had a feeling of faintness, with a sudden sinking, and a peculiar motion, as he stated, in the tumor, which from that time greatly diminished in bulk, giving the conviction, to those who had seen him most, that the contents of the supposed hydatid tumor had escaped into the abdomen, without, however, producing any unpleasant symptom, except, perhaps, a little sickness at the stomach.

Oct. 26. I saw him at his own house: the tumor had subsided; but there was evident fulness and fluctuation at the pubic region and below the umbilicus. He had taken two or three doses of calomel, followed by sulphate of magnesia; and had passed a tolerably healthy loose dejection. He had experienced a little pain that afternoon in the lower part of the abdomen, but very little tenderness. His chief pain was in the act of passing urine, as if from the contraction of the bladder. Pulse about 140, sharp: tongue slightly furred: countenance flushed.

27. No bad symptoms: bowels freely opened by the calomel, of which he had taken two grains three times a day, since the 25th. Pulse 120: no sickness: no tension of the abdomen.

28. I examined the abdomen very carefully, and found the margin of the liver much raised above its former position, descending only half-way to the umbilicus, and not apparently adhering to the diaphragm. The fluctuation at the lower part of the abdomen was diminished: there was neither tenderness nor pain. Bowels well open: he had scarcely moved from the same recumbent position, and had eaten nothing but a little gruel each day. Pulse 96. The ribs still bulged a little on the right side.

Rep. Pil. Hydrarg. gr. iij. Ext. Conii gr. iij. bis die.

Mr. King, who observed this case very attentively from the first, has just now informed me, that he soon began to manifest signs of amendment, to sit up, and to take food; and not long after, it was evident that the fluid in the peritoneum was decreasing in quantity. At that time, the displacement of the ribs was still great, and there was a considerable lateral curvature of the spinal column. He continued for some months in a very emaciated state. His

present condition (Sept. 7, 1837), Mr. King says, is decidedly good. He is by no means thin, has some natural colour, the spine is straight, the abdomen not full, and the thorax is almost symmetrical.

He works for a printer; and has no complaint but that of a painful weakness in the left knee, which, as well as the right, seems to fall inwards, more than it has been wont to do.

If, instead of discharging into the peritoneal sac, the hydatids fortunately escape from the body, the event is occasionally favourable; though, as the organs through which the hydatids pass are liable to be inflamed and irritated, such a discharge may, at last, lead but to a more protracted fatal disease.

In the First Volume of this work a case is related, which occurred under my care in the Clinical Ward, where an hydatid cyst in the liver opened into the lung; and a considerable number of the hydatids, mingled with bile, were evacuated, in their collapsed state, by expectoration;—the patient ultimately doing quite well, and leaving the hospital without any obvious remnant of the disease.

Another case, almost precisely similar, has been stated to me by Dr. Babington, as occurring many years ago, under his observation, in the practice of his father. In that case it likewise happened to a young woman, who, after suffering a considerable time from symptoms of very serious hepatic derangement, with cough, began to expectorate hydatids, which she brought up to the number of several hundreds, and many of them unbroken: they were yellow, and deeply tinged with bile, leaving no doubt of their hepatic origin. After going on for some time, this expectoration ceased, and the young woman recovered completely.

CASE 14.

Hydatids in the Liver, supposed to have passed off by the Intestines.

In the spring of the year 1824, I was consulted by a shoemaker, about 50 years of age, whose abdomen was enlarged,

almost like that of a man labouring under ascites, and the superficial veins were distended to a great size. On examining the abdomen more attentively with the hand, it appeared that a tumor, fixed in the right hypochondrium, occupied the whole of the right side of the abdomen, passing considerably beyond the linea alba, so as to encroach upon the left side also. To all appearance, this tumor was connected with the liver: it was elastic, and pretty smooth, though it varied in its hardness in different parts. He represented himself as having never possessed a very strong constitution; but having lived so temperate a life, that he was never but once intoxicated, he had always been able to work hard at his trade. About a year and a half ago, he had begun to feel out of health, with lassitude and drowsiness. About a year ago, while walking along, he was suddenly seized with a very acute pain in the right hypochondriac region; which lasted, in spite of remedies, for a few days, and then subsided gradually, leaving a dull aching pain; and at that time he first perceived the enlargement, which had continued to increase to the present time, when his general health was beginning to suffer, and his respiration to be impeded. He was put upon a course of taraxacum and soda, and the camphorated mercurial ointment rubbed upon the abdomen till the gums were affected. In the month of July, three or four months after his first application, he was seized with a fit of vomiting, in which he brought up half a pint of what he called "matter"; and shortly after, passed, by stool, a large quantity of what, from his description, could have been nothing but hydatids: some were only skins or cysts, but others were full and round. This evacuation was attended with an immediate subsidence of the tumor; and when I saw him, on the 8th of August, the swelling had not increased again, and was very inconsiderable in comparison with what it was at first, though it was still to be partially detected.

It occasionally happens that hydatid cysts approach so near the surface, that, inflammation taking place, they discharge themselves externally; the result of which may be

favourable, or not, according to circumstances. I remember, some years ago, being taken by Dr. Stroud to visit a female, in whom, judging from her own minute account, this had taken place several years previously; but though one cyst had probably discharged in this way, her abdomen was still the seat of tumors, which had all the characters of hydatid cysts. The following case, however, in which there can be no doubt of the fact, was communicated to me by Dr. Babington; and I shall state it in his own words.

CASE 15.

*Hydatid Cyst in the Liver, discharging itself externally:
and Death from Hæmorrhage.*

"It was during an attendance, two years and a half ago, on some other patient, with my friend Mr. May, of Bow Lane, that he requested me to see Mrs. Rastall, a poor woman, whom he represented as labouring under visceral disease of a remarkable character. I found her in bed, much weakened by sickness and dyspepsia. Her skin was of a deep yellow hue; and her secretions sufficiently demonstrated an obstruction to the natural course of the bile. This state of jaundice was described to have existed for many months. On examining the abdomen, a hard tumor, irregular in figure, and rising into roundish masses, was felt on the right side, issuing from beneath the ribs, and extending to the pit of the stomach. Thus there seemed every reason for supposing an enlargement of the liver; but its precise boundaries could not easily be traced, in consequence of a further enlargement of the rest of the abdomen, dependent on an advanced state of pregnancy. In the tumor first mentioned there was no fluctuation. The whole presented a firm solid growth, free from pain; and the symptoms to which its presence gave rise, were such as might proceed from any cause of hepatic obstruction. From time to time I learned from Mr. May the state of his patient. She gave birth to a healthy child; which she was able to suckle, notwithstanding her permanently jaundiced condition: and I may remark, by the way, that neither the skin of the child nor the mother's milk was in the slightest degree tinged with bile. Her general health must, indeed, have materially

improved; for she again became pregnant, went her full time, and bore a living infant. After her first confinement, when I took an opportunity of examining her, the tumor was more distinct and larger than before; and I was subsequently informed that it continued to increase in size. In the beginning of December last, Mr. May again requested me to see Mrs. Rastall; and informed me, that, a day or two before, the parietes of the abdomen had spontaneously given way, and an enormous discharge of fluid had issued from the aperture. On removing a poultice and bandage, which had been subsequently applied, I found an ulcerated opening, rather less than an inch in length, situated immediately below the umbilicus. From this opening a portion of what, at first view, bore a general resemblance to intestine, protruded about half an inch. On closer examination, its collapsed and puckered form, its total insensibility, and its greater thickness, led to a belief that it was the empty cyst of an hydatid; and, by gradual and gentle traction, I succeeded in bringing it away. The part which passed last was thinner, and more gelatinous in appearance, than the rest; and was torn in coming out. The whole was nearly as large as a bullock's bladder; and would probably have contained, previously to its rupture, a gallon and a half of fluid. No pain was felt during its abstraction; and the patient expressed herself as relieved by its removal. We saw her on the following day, and found that she had passed a good night. A second cyst now presented itself at the aperture; but as it seemed, on gentle traction, to be adherent, no force was used to withdraw it. The bandage with which the abdomen had been bound was soaked by a constant drainage of serous fluid. On the day following my second visit, blood, instead of serum, began to make its appearance; and this was accompanied by such a degree of prostration, rigor, and faintness, as led to the apprehension that some serious internal hæmorrhage was taking place. This was verified, as the day advanced, by more alarming seizures of syncope; and one of these proved fatal, in the course of the night. That hydatids had caused all the mischief in this case, was demonstrated during life; and an examination, after death, proved that one of these had formed in the

interior of the liver, near its under surface; forcing, as it grew, the substance of that organ upwards and forwards, and its posterior peritoneal coat backwards. A large cavity, lined with a false membrane, and filled with grumous blood, was found thus bounded. A second hydatid, the cyst of which remained, seemed to have occupied a portion of the same cavity; and a third, about the size of a walnut, appeared on the convex surface of the right lobe. Mr. King, of Guy's Hospital, has, I understand, succeeded in finding the mouth of an hepatic vein, whence the fatal hæmorrhage had its source. Mrs. Rastall's age was about 35. The tumor which caused her death was first observed by Mr. May, in March 1833; and she died on the 9th of December 1836."

I have thus brought together fifteen cases, occurring chiefly under my own observation; in most of which the existence of hydatids, in immediate connection with the cavity of the abdomen, has been placed beyond a doubt, either by their discharge during life, or by examination after death; and they may be considered as forming a series, which includes a fair view, not only of the general history, progress, and result of such cases, but likewise of most of the particular facts, occurrences, and accidents which may be expected to present themselves to the practitioner during their course.

The history of this disease, when viewed attentively, is curious and interesting. The little hydatid first introduced, or generated in the structure of the human body, gradually increases in size; producing, by its pressure, displacement and absorption of the surrounding parts; and leading to the deposit of lymph, and the gradual formation of a cyst, in which it becomes, as it were, insulated, interfering only by its bulk with the processes of the system. In some instances, it would appear that the principle of reproduction is not possessed by the individual hydatid; but, more generally, an indefinite multiplication takes place; and the new progeny may be traced arising again from the internal surface of many of the secondary and successive hydatids, and

gradually increasing in size till they burst the cysts in which they have been generated. It is however remarkable, that while some, which have arrived at a very considerable size, still only appear to be producing the smallest offsets, others, when they seem but just to have separated from the internal surface of the parent, are pregnant with a new progeny, bearing so large a proportion to the whole dimensions of this young parent cyst, that they are already prepared to dilate it, or to escape from it, and mingle with those which float in the fluid contained within the older hydatid.

The first parent cyst, which now forms a lining to the cavity it has made for itself in the tissues of the body, continues to increase; but in vain can that increase be expected to keep pace with the internal multiplication of its offspring, which, pressing upon each other, are ruptured; and the fluid which escapes seems to form a pabulum for those which still retain entire the small degree of vitality with which they are endowed. It must likewise undoubtedly happen, that some are ruptured by the enlargement of those within them, when they attain a considerable size; but it is not very common to find those which have arrived even at a medium growth ready to give way, from the increase of their internal cysts; the multiplication generally taking place so rapidly, as to burst them before they arrive at that size. We do not know how long the original hydatid, which forms the lining to the whole cavity, is capable of existing, but probably for many years; and, as long as it does exist, it seems to serve as a complete protection to the whole of its contents, from the action of the absorbents of the organ in which it is developed: it often increases very much in thickness and firmness, and seems connected only by the juxta-position of its external surface with the interior of the cyst of coagulable lymph or thickened membrane, which belongs properly to the body, and not to the hydatid. As soon as, from circumstances, the protecting hydatid dies, it separates from the cavity, curls itself up, and falls down amongst the other débris:—then, probably, the absorbents first begin to act upon the fluid: but whether they ever act on the more solid parts of the semi-membranous cyst of the hydatid itself, may be doubted: at all events, their action is

very slow, so that the remnant of an hydatid, retaining all its usual character, was found in one of the cases related above, which must have belonged to a cyst three or four times larger than the cavity in which it was discovered; shewing, that it must have remained unacted upon by the absorbents, while the cavity was contracting in that degree, and while the proportionate quantity of fluid was being absorbed. The absorbents do, however, gradually take away almost every drop of the fluid; reducing the contents of the cavity to a state of dryness, in which the original forms of the membranous structures become lost: and pressed together, and deprived of moisture, the mass assumes a paste-like, and almost cretaceous, consistence. I am inclined to believe, that as soon as the protecting cyst is separated from the cavity, there is no longer any security for the rest; for as the cavity contracts, which it does in proportion as the fluid is absorbed, it becomes a constantly opposing agency; and as quickly as, by its own contraction, or by the distention of the hydatids themselves, fresh hydatids are ruptured, the absorbents of the cavity take up the fluid; and nothing but the close application of another hydatid cyst to the whole absorbing surface, which is obviously almost impossible, can put a stop to the work of destruction.

With regard to the cyst in which the hydatid is placed, that undergoes such changes as an adventitious structure, formed from the vessels of the parts by the irritation of a foreign body, and itself often well supplied with vessels, may be expected to exhibit: and that it is capable, during some periods of the disease, of very active processes, may be inferred from the great vascularity sometimes observed; as was particularly marked by the diffused pink colour in one of the active and healthful parent cysts mentioned in the examinations of the first case in this communication. Its vascularity is also marked by the occasional effusion of blood between the cyst and the hydatid; mentioned, in one case, as discovered after death, and itself bearing part in the fatal termination of another case. Suppuration, also, is not unfrequently established in the cyst; as is proved, by many cases, related above, to have taken place, as a source of great irritation to the system, and occasionally the more

immediate cause of the fatal result. Morbid appearances are likewise impressed upon the containing cyst by the presence of bile, which has either found its way at once from the liver, or has been poured into the cavity by communication with the gall-bladder. Another alteration, which is very often observable in the cyst, is, a more or less perfect conversion of it, generally or partially, into cartilaginous or bony matter, which must interfere considerably with its power of distending: and how far this, or any of the other changes, take place antecedently to the separation of the hydatid lining its walls, may be matter of doubt; but certain it is, that some, at least, of these changes must necessarily lead to the derangement, if not to the disintegration, of the hydatid.

Of the treatment of this disease I have little to say. While confined to one cyst, whether formed by a solitary hydatid, or by one which is productive, and therefore contains within it a number of others, I believe that an opening, or a puncture, offers the best chance of cure: and if the cyst be solitary, it is not unlikely that the result will be satisfactory. If, on the contrary, the cyst contain a great number, much risk will be incurred, lest some of the excessively minute bodies should find their way into the peritoneal cavity; where, in all probability, though they might not produce any intense inflammatory action, they would gradually develop themselves and multiply. On the other hand, there is great danger in the existence of such a cyst, lest it should burst suddenly into the abdomen; and then the extent of mischief is incalculable: so that, supposing our diagnosis quite certain, there would be the greatest justification in performing the operation. As, however, our diagnosis in a single cyst is infinitely more difficult than when the disease becomes diffused, it will be always right to employ an exploring needle, such as has been recommended by Dr. Davies in cases of empyema, before an opening is made. Should the operation be performed, the most careful treatment must afterwards be adopted, to prevent any portion of the fluid, which will almost certainly be left behind in the cyst, from passing into the abdomen.

In what way the puncturing of an hydatid cyst might be expected to prove useful, is a question worth inquiry. If the cyst contain numerous hydatids, it will be no easy matter to make such an opening as would allow the larger of these bodies to escape, without too great a risk to the patient's life; but perhaps this might not be necessary to the success of the operation. I imagine one of the best results which could arise from the operation, would be the destruction of the parent or protecting cyst. Whether a simple puncture would effect that purpose, I cannot say; but probably it would; more especially as, when a considerable portion of the fluid contents of the cavity was withdrawn, the cyst would be likely to fall in, and separate from the parietes of the cavity, and thus subject the whole contents to the influence of absorption: but this result would be more certainly obtained, if a more extensive rent or separation could be inflicted on the hydatid. In the cases which have been detailed, there are three instances of the external discharge of the hydatid, besides those discharges which have taken place by the intestines and the lungs. Of these cases, one was spontaneous, and was followed by hæmorrhage from the cyst, after the separation of the hydatid. In another case, suppuration was far advanced in the cyst, before recourse was had to the operation. In the third, the operation was performed upon an hydatid which proved apparently to be solitary and unproductive, and a cure was effected. Here, probably, the cyst was destroyed; and being separated from the walls of the cavity, which were healthy, the absorbents acted as far as was necessary, while the cavity contracted.

The chief good which it appears likely that medicine can effect, is to excite the action of the absorbents when the parent hydatid is dead or separated: for till that preliminary step is obtained, the absorbents may act upon the system, but are not likely to act upon the hydatid, or the fluid contained within it; and it would be a legitimate object, in the administration of medicines, to destroy the life of the parent hydatid: but, as yet, we know little upon this point of treatment. Whether repeated doses of turpentine, or other diffusible substances, might have any effect, or whether the

more local agency of electricity might be applied directly to the part affected, is a subject of fair speculation ; though so little is at present known of the agents which are able to **destroy** the hydatids, that such propositions must be classed as unsupported conjectures : and, amongst them, it might perhaps, be permitted to mention the assiduous application of ice to the tumor, as calculated to lower the animal temperature locally, and thus interfere with one of the conditions on which probably hydatid life depends, without at the same time inflicting such violence upon the containing cyst as is likely to induce suppuration, from which we have seen, in many of the foregoing cases, that very dangerous or fatal consequences will probably ensue.

PLATE I.

Presents a general outline of the Human Abdomen, as seen in a front view, divided by dotted lines into its several regions.

The scrobiculus cordis, and the two hypochondriac regions.

The umbilical and the two lumbar regions.

The pubic and the two iliac regions.

***Fig. 1.* is intended to represent the outline of the Male ; and**

***Fig. 2.* of the Female form.**

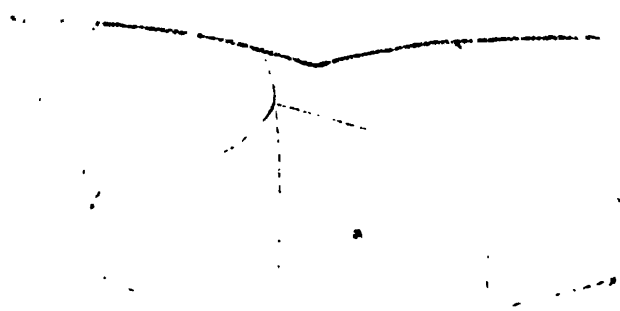


PLATE I

THE
SOUTH-WEST CORNER
OF THE TEMPLE
OF KARNAK
AT THEOPHILUS
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Fig. 1.

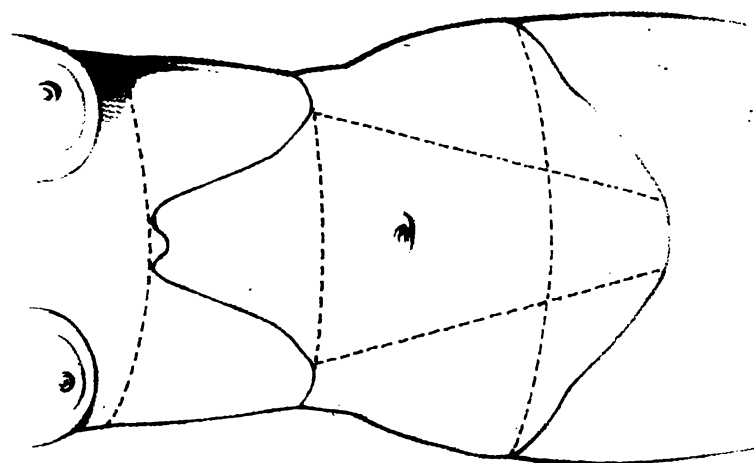
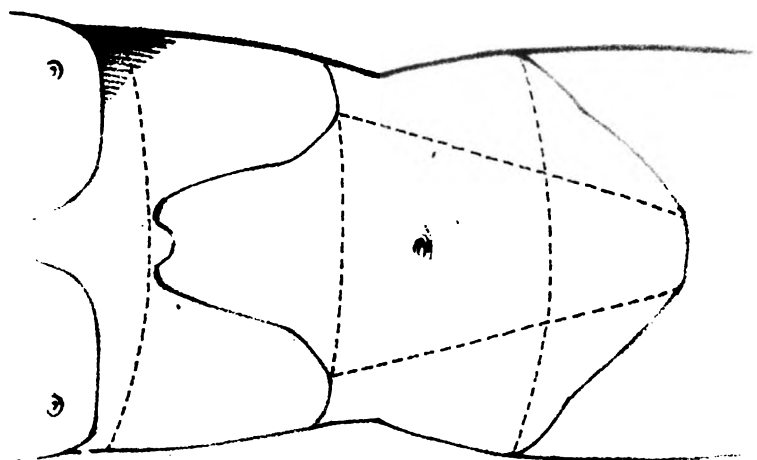


Fig. 1.



Printed and Published by H. K. Mearns

Published by S. Highley, Fleet Street

PLATE II.

Presents two outline figures of the Male Abdomen, as obtained by a brass plate properly prepared for stencilling; by means of which, such an outline may be transferred to the blank page of a note-book in a few seconds. The plate from which this outline was obtained, as likewise one of the Female figure, was made, under my instructions, by Mr. Bentley of High Holborn; and may be had, by any one, at an expense of two or three shillings.

Fig. 1. has had the marks drawn upon it, signifying the situation of abdominal tumors which occurred in a case of cerebriform malignant disease.

Fig. 2. is intended to mark the situation of several abdominal tumors in a case of hydatids.

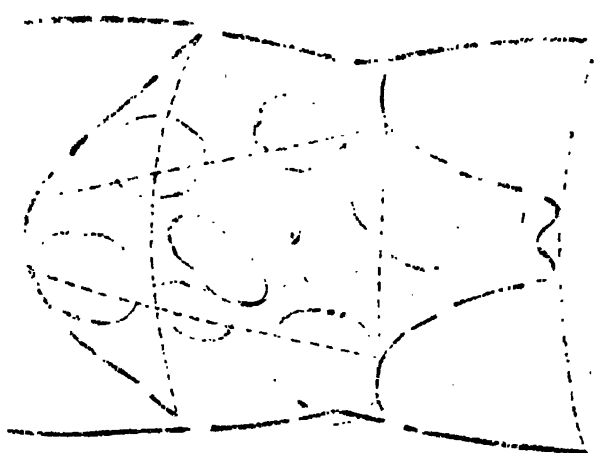
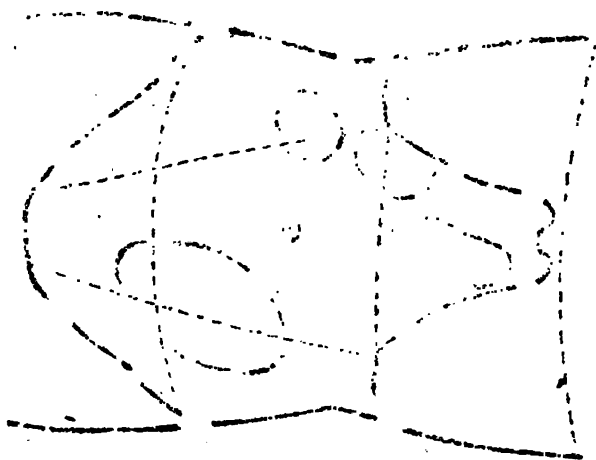


Fig. 1.

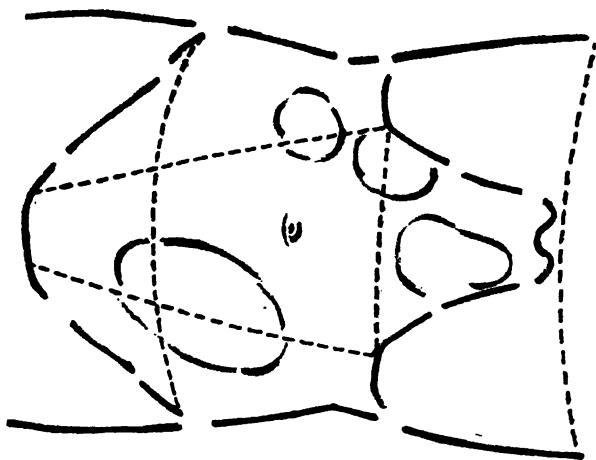
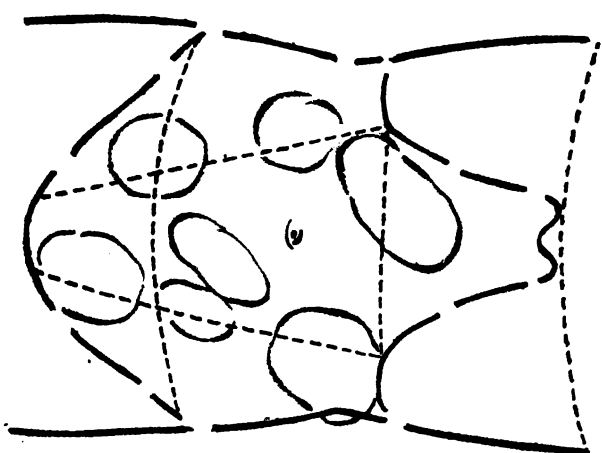


Fig. 2.



VOL. II.

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Fig 1

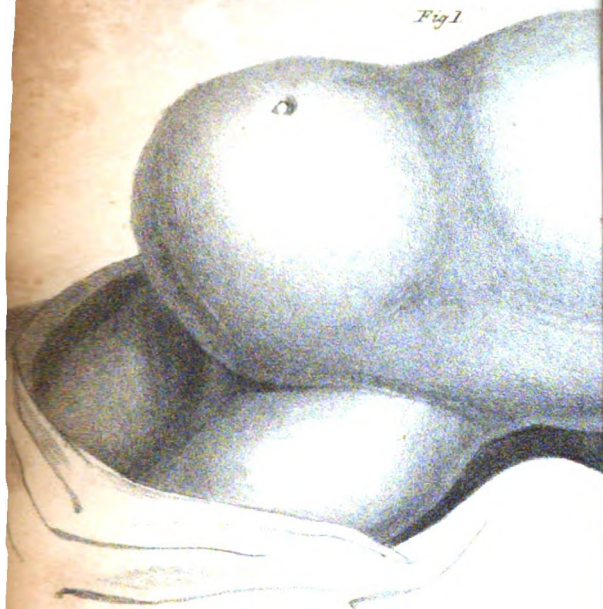
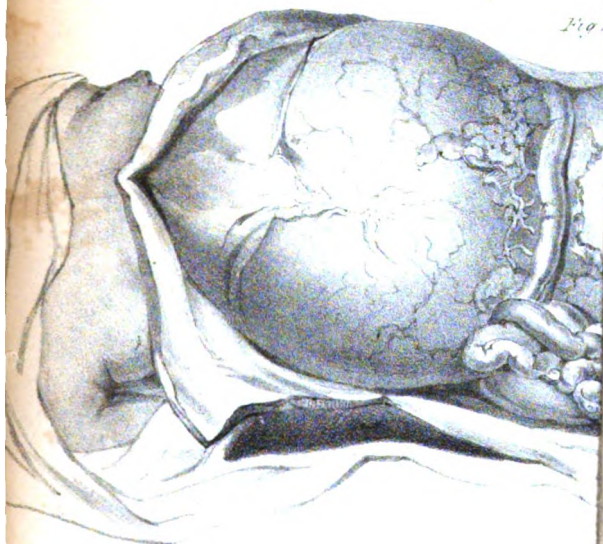


Fig 2



Drawn by C. J. Canton

PLATE IV.

Figs. 1, 2, 3, 4, and 5, represent different appearances of minute Hydatids, from Case 1, as seen through Amici's microscope.—Figs. 6 and 7 are representations of the natural size, from Case 2.

Fig. 1. A very small portion of an unbroken Hydatid, as seen through Amici's microscope. (p. 447.)

Fig. 2. Internal surface of a portion of Hydatid, as seen through the microscope. (p. 447.)

Fig. 3. A cluster of very minute Hydatids, as seen through the microscope. (p. 447.)

Fig. 3, a. The natural size of the cluster of Hydatids.

Fig. 4. A cluster of small Hydatids, seen through the microscope. (p. 447.)

Fig. 5. A collection of minute Hydatids, as seen through the microscope. (page 447.)

Fig. 5, a. The natural size of fig. 5.

Fig. 6. Appearance presented on the internal surface of some Hydatids; natural size. (p. 454.)

Fig. 7. Another peculiar appearance occasionally seen on the inner surface of an Hydatid; natural size. (p. 454.)

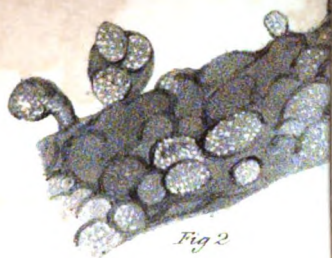


Fig 2



Fig 3a

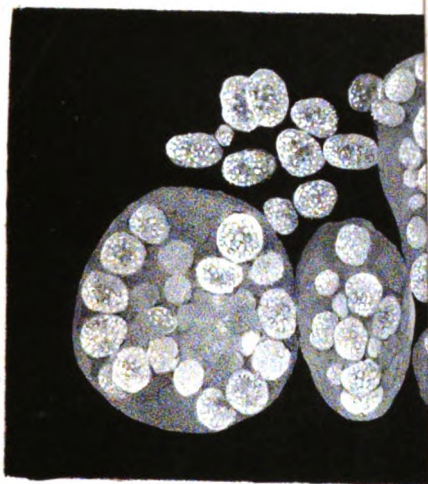


Fig 4

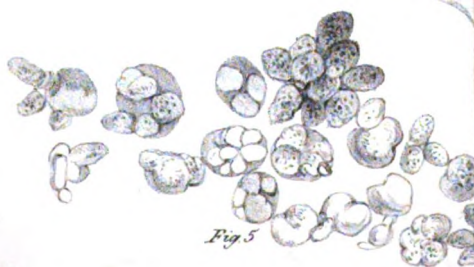


Fig 5

Fig 5a

PLATE V.

REPRESENTS A SMALL PORTION CONSTITUTING, PERHAPS, A TWENTIETH PART OF THE LARGE MASS OF HYDATIDS WHICH CAME INTO VIEW WHEN THE ABDOMEN OF CULLUM (CASE 2) WAS LAID OPEN.

The appearance of the Hydatids in the omentum, was that of sacs, not larger than moderate-sized potatoes; but, frequently, two, three, or four of them were found to communicate together, with a very imperfect septum between them, or only a depression in their surface; over which, in general, a vessel of the omentum was observed to pass, as if it had been in part the means of producing the form. On opening the sacs, they were found to be of a semi-cartilaginous consistence, so firm, that, when completely emptied, they maintained their spherical form; and when all the hydatids had been removed, the sacs were lined with a somewhat scabrous yellow structure, formed by an irregular coating of coagulable lymph. They were generally filled with a great number of pellucid hydatids, full of the most transparent fluid. The hydatids were of all sizes, from a pigeon's egg to a mustard-seed, spherical in shape: some of them were imbedded in the rough lining of the cartilaginous sac; and thus it appeared little pouches were sometimes formed, probably swelling afterwards into other subordinate sacs. Many, both large and small, appeared to have been burst by the pressure of the rest, so that they were squeezed quite flat; but it was remarkable, that, in most of these instances, there was no fluid effused in the sac, but that it was quite full of the turgid hydatids, or the skins.

In a few instances, of which the hydatid to the right of the drawing was one, and which the space would not allow me to introduce in this Plate, where a single hydatid had formed the lining of the cartilaginous sac, no others had developed themselves. In this instance, the single hydatid seemed to have been lately ruptured, and the sac was full of the water, in which the skin was seen curled up: the water contained thousands of little opake white bodies, not much larger than sand, apparently of one shape and size, being all spherical: they were rather heavier than the water, and soon subsided to the bottom. They were not examined in a microscope, but were, probably, small hydatids.



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PLATE VI.

Represents the Abdomen of Dawson (Case 3. page 455), as it presented itself in June 1828, when the existence of Hydatids was first discovered.



On the 10th of 2 months by Fairland

T. Gordon

PLATE VII.

Represents the Abdomen of Dawson, as it presented itself in Oct. 1836; more than eight years after the sketch which is seen in Plate VI. was taken.

The projecting tumor, a little below the right mamma, which contained a solitary Hydatid, was believed to correspond with the lower of the two projecting tumors on the right side of the abdomen, in Plate VI.



PLATE VIII.

Represents the Abdomen, seen in Plate VII., laid open, and the integuments dissected carefully from the Hydatids; to which the whole parietes were closely and firmly glued by thick deposits of adventitious structure. The disproportion between the abdomen and the thorax, encroached upon as it was by the disease, is very remarkable.



ON THE INFLUENCE
OF
ELECTRICITY,
AS A REMEDY IN CERTAIN CONVULSIVE AND SPASMODIC
DISEASES.

BY DR. ADDISON.

It must have occurred to every one engaged in extensive practice, to meet with cases of convulsive and spasmodic disorders affecting females, and with cases of chorea in both sexes, which, whilst they occasioned extreme distress to the patient, and to the patient's friends, have baffled every attempt to afford permanent, and, in some instances, even temporary relief. It was whilst brooding over the humiliating failure of a host of remedies employed in one of such cases, and which will be described in the sequel, that, as a last resource, I determined upon giving electricity a fair trial. I was perhaps, in some measure, induced to do so, in consequence of having an opportunity of securing the assistance of Mr. Golding Bird, in its application. The effect produced by it at once gratified and surprised me; and led to further trials, the results and particulars of which will not, I trust, be deemed altogether unworthy the attention of the profession.

Of course, all claim to originality, or even novelty, is out of the question; electricity having long been enumerated amongst the ordinary remedies applicable to convulsive disorders generally. It is, nevertheless, much to be feared, that many persons, like myself, have been led greatly to underrate its efficacy, either in consequence of its vague and indiscriminate recommendation, or from the inefficient and careless manner in which it has been applied. Certain it is, that, although I have often ordered it myself, and have more frequently witnessed its employment by others, I had never for a moment entertained the belief that it possessed

the power over the disorders alluded to, which I am now inclined to concede to it. It is almost superfluous to observe, that the convulsive and spasmodic disorders of females alluded to, are such as, in a large majority of instances, are connected with some irregularity of menstruation: neither is it necessary to dwell upon the difficulty of distinguishing merely functional from organic diseases of the nervous centres; these being matters with which the profession at large is perfectly familiar.

It is but right to state, that the following cases have not been selected because the treatment proved more or less successful, to the exclusion of others in which it failed: on the contrary, they comprise the whole of the cases hitherto subjected to the electrical process about to be described; and hence afford, as far as they go, a fair promise of at least occasional benefit, from the application of this powerful agent in the treatment of the disorders specified.

However undesirable it may be to encumber our Reports with a detailed history of cases, such a mode of procedure becomes almost indispensable in the present instance; but, in order that the length of this communication may not greatly exceed its importance, I shall, without further comment, proceed to lay before the profession a brief description of the mode in which electricity was applied in the subjoined cases, as drawn up by our electrician, Mr. Frederick Bird.

" In the following cases, the form of electricity employed, was, with one exception, that elicited by means of the common electrical machine; being made use of either by taking sparks, in the course of the spine; or in the form of shocks, passed through the pelvis.

" In the former case, the patient was seated on an insulated stool, and a metallic connection made between the prime conductor of the machine and the body of the patient: a brass ball, furnished with a wire or chain, in connection with the earth, was then passed upwards and downwards, in the direction of the spine, at a distance of about an inch from the surface. The machine being at this time excited, the patient became charged, and the electricity continued to

pass off, accompanied by sparks, to the brass ball, and thence escaping, through the medium of the wire or chain, to the earth: in this manner a rapid succession of sparks could be maintained; and which, in the present instances, was continued until an eruption followed, which assumed very much the appearance of lichen urticatus; the time necessary for its production varying, in different patients, from five to ten minutes.

"For the purpose of passing the shocks, the following method was had recourse to. A large-sized Leyden jar was so placed, that a communication was established between its inside coating and the prime conductor: a "Lane's electrometer" was then fixed into one end of the conductor, so as to admit of the insulated ball of the former instrument being either in contact with, or at any required distance from, the latter: a chain was placed in contact with the outside coating of the jar, and another was attached to the ball of the electrometer; the ends of both of which were furnished with directors, for convenience of application.

"One of the directors was then held upon the symphysis pubis, whilst the other was placed upon the sacrum*; by which means the electric current, in performing its circuit, was made to pass through the pelvis. The ball of the electrometer being then placed at a certain distance (generally $\frac{3}{8}$ ths of an inch) from the prime conductor, motion was given to the machine, and the charging of the jar commenced; and upon a sufficient quantity of electricity being accumulated to enable its discharge to take place by means of the electrometer, the shock was felt. By adopting the use of an electrometer of this kind, the violence of the shocks is made to depend upon the distance of its insulated ball from the conductor of the machine, and not upon the capacity of the jar: hence, it is only necessary to place the ball at a greater or less distance from the conductor, in order to proportion the intensity of the discharge to the nature of the disease or powers of the patient.

In one case, that of Jessie Wick, the magnetic-electrical machine was made use of, the patient's strength not being

* There is a female in attendance, for the purpose of adjusting that part of the apparatus more immediately connected with the person of the patient.

sufficient to admit of the ordinary and more powerful form of electricity. The larger helix having been adjusted to the machine, one of the two conducting wires, furnished with a brass disk, was placed over the cervical portion of the spine; whilst the remaining wire, which was also provided with a disk, was fixed over the lumbar vertebræ: the helix being then slowly revolved, a succession of shocks was obtained, which were thus made to traverse the course of the spinal column."

The following Cases were taken from the Hospital Books, by my pupils, Messrs. Brereton and Aspland.

CASE 1.

JESSIE WICK, aged 17, admitted May 14th, 1837, under Dr. Addison;—a stout, intelligent, well-developed girl, of rather nervous temperament. Her health seems to have been generally very good till the age of 14; at which time, being of remarkably forward sexual development, she began to menstruate. The catamenial discharge immediately became irregular, recurring every fortnight, lasting three days, and accompanied by acute pains in the loins and genital organs. She does not appear, however, to have suffered materially in her health from this irregularity. Two months since, while menstruating, she suffered violent fright; which was immediately succeeded by cessation of the discharge, hysterical fits, and continued trembling of the limbs, much increased by excitement. Bleeding, with blisters and purgatives, was tried: but no relief appearing, she was admitted into Miriam Ward, under Dr. Addison; her condition being as follows:—She is utterly unable to remain in a state of rest for a moment: her limbs, especially the upper extremities, are violently agitated: the mouth is from time to time ludicrously distorted. The most unvarying motion is, a rolling of her clenched hands quickly round each other, with a thrusting forward of the right in a very systematic manner, it occurring after every third revolution. Deglutition and speech but slightly affected. Occasional pain in the head, back and loins, and under the left mamma: palpitation of the heart, but no abnormal sound. Her spirits are

good, but she is fatigued from the continued action of her muscles. The catamenial discharge is expected in two or three days.

The bowels, which had been obstinately costive, having been, by strong purgatives, freed from much highly offensive matter, creosote, in m. ij. doses was exhibited thrice daily; but violent retching following the seventh dose, it was discontinued. Her spasmodic twitchings, palpitation, and restlessness, were aggravated. Purgatives were continued; and camphor mixture with hydrocyanic acid, and sulphate of zinc, with hyoscyamus and camphor, prescribed. In spite of these remedies, not the slightest abatement occurred in her symptoms: her nights were sleepless, and her irritability excessive. On the 20th of May the catamenial discharge re-appeared, being somewhat after its proper period, scanty, and accompanied by severe bearing-down pains in the back and loins. It ceased again at 2 A.M. of the 21st. From this date, till June 14th, she continued the use of purgatives; with occasional cupping over the loins, blisters along the spine, the above-named mixture, and increasing doses of zinc, reaching at last thirty-six grains daily. Once, on the 23d of May, the catamenia returned, but in a few hours disappeared again; and at the next and succeeding periods were absent. Not the slightest abatement in her unpleasant symptoms took place: the arms were, perhaps, a little less violently agitated, but the lower extremities, which till late in May had been comparatively quiet, now became much disturbed, and kept up a continued clapping of the feet against the floor: the mouth and eyes, too, were more severely affected than formerly. On the 28th of May, in addition to the other remedies, dashing of cold water on the head, and along the spinal column, was introduced: but this was necessarily omitted for a time, in consequence of the increasing violence of a cough, which had long troubled her, and which was now accompanied by copious bronchial secretion, deeply tinged with blood. She now stated, that some time previous to admission she had been similarly affected. Under depletion and mercurials, this soon yielded; and the former remedies were vigorously applied till June 15th; when the zinc producing constant nausea, the carbonate of iron, in 3 fs.

doses, thrice daily, was substituted for it. On the 23d of June, the sulphate of iron was substituted in increasing doses, reaching thirty-two grains daily, till August 14th. A very great improvement evidently followed the exhibition of sulphate of iron, assisted by purgatives, chiefly, of calomel and compound extract of colocynth, or aloes and myrrh, and the use of the shower-bath. She was enabled, under this treatment, to sit nearly still in a chair, unless talked to, or otherwise excited; and, with assistance, she could walk pretty well about the ward: there was, however, always a dragging of one or the other of the feet. The squinting, and distortion of the face, had very much subsided, and the peculiar revolving and thrusting forward of the hands diminished: the least excitement, however, would speedily aggravate considerably all her unpleasant symptoms. Aug. 15th, having then been in the hospital exactly three months, she quitted with an intention of going to Ramsgate. For two months from her departure we heard but little of her; but on October 15th she presented herself at Guy's Hospital, among the out-patients, in a much worse condition than she had ever yet been. It is true, there was less agitation of the limbs, but it had only given place to more alarming symptoms. From her friends' statement it appeared, that before reaching her destination she had been seized with epileptic fits, which she had never experienced before. They were represented to have been severe, and, in spite of remedies, had left her in the state in which she appeared: on their approach, the chorea had subsided. She had a foolish imbecile stare, the face dull, she appeared to be almost regardless of surrounding objects, articulation was lost, and she made no attempt, even by signs, to express her feelings. The twitchings of the upper extremities, mouth, and eyes, were less: the inferior extremities appeared paralytic, at least she made no attempt to move them, nor was she able to stand; her bowels were said to be regular; there had been no return of the catamenia. She was immediately put upon ʒi. doses of carbonate of iron, and used the shower-bath; and a blister was applied to the spine, along which there seemed to be pain on pressure. The bowels becoming costive, drastic purgatives were

again necessary, and croton-oil was given. On the 20th of October the sulphate was substituted for the carbonate of iron; but under this treatment no amendment was produced. After one of her fits, she lay perfectly comatose, scarcely seeming to breathe; and it was not till repeated assafoetida injections had brought away large quantities of fecal matter, deeply tinged with iron, and stimulating remedies had been used, that her consciousness, and with it articulation, were regained. Oct. 25th, sulphate of zinc in grain doses thrice a day was used, together with a mixture composed of camphor mixture and ammoniated tincture of valerian; and occasional blisters along the spine. The zinc was rapidly increased, almost $\frac{1}{2}$ gr. daily, till she took 36 grs. per diem, added to which was the ferri sulph. But to no purpose: her chorea returned almost as severely as ever; the epileptic fits were frequent, two or three daily, the longest interval between them being three or four days. She could seldom leave her bed; and to guard against her falling from it, side- and foot-boards were necessary. She had now, also, constant headache, which was always aggravated on the approach of a fit; and her spirits became low and desponding. During the epileptic paroxysm, she had violent opisthotonos, the superior part of the occiput almost meeting the heels; firm contraction of the flexors of the fingers and toes, with equally firm contraction of the extensors of the fore-arms and legs; much thick foam from the mouth; stertor; largely-dilated pupil;—the heart's action was quick and tumultuous; with a sound resembling that observed in chlorosis, distinctly heard at its apex. In this condition she would remain from ten to twenty-five minutes; after which, a quick squinting of the eyes, with frequent relaxation and contraction of the flexor muscles of, the fingers and toes, would occur: she would then sink into a deep sleep and awake from it after many hours, pale, languid, and perfectly unconscious of all that had happened. It was remarkable, that the slightest touch, when the violence of the paroxysm was subsiding, would instantly reproduce it. In this state she continued many months, with, perhaps, some alleviation of the epileptic attacks, but no improvement in her chorea. The symptoms of the latter were the same as

during her former attack—clapping of the feet against the floor, contortions of the mouth, squinting, with revolving and thrusting forward of the hands.

As a last resource, Dr. Addison ordered electricity. Her strength not allowing of the severer application, electro-magnetism was commenced. It caused continued spasm of the flexor-muscles of the arm; so that, till the current was discontinued, she could not relax her grasp of the brass handles. This was commenced on the 20th of April; and on the 10th of the following month she was so far improved, that she could use her needle with tolerable precision: her general health improved; and the fits became slighter, though as frequent as before. Sparks were now drawn from the spine every other day; each exhibition continuing till a vivid eruption was produced. Her improvement was most marked: at the end of a week she was able to walk across the room without assistance: her countenance gradually became less anxious, and the fits declined in frequency.

June 1. Twelve shocks, through the pelvis, every other day, were ordered. The first administration, at the distance of three-eighths of an inch from the conductor, was followed by severe abdominal and pelvic pains, the immediate precursors of the catamenia. The secretion continued for four hours. Shocks to be discontinued.

July 3. Improvement uninterrupted: occasional twitchings are the only indications of chorea. The catamenia have not appeared this month.

A second exhibition of the shocks again occasioned the development of the catamenial function: in six hours it became arrested; after which, she vomited a small quantity of blood.

July 15. She left the hospital entirely free from chorea; though still subject to fits of diminished force and frequency.

CASE 2.—*Chorea.*

EMMA HILLIER, aged 14, stout, plethoric, of dark hair and eyes, admitted June 14th. Her mother states, that, from an early age, she has been subject to epileptic seizures; and four years ago was brought into the hospital with a severe

attack of chorea. She was cured at the end of ten weeks ; and since then has had periodical returns, the attacks generally observing the recurrence of spring and autumn. The present attack is not severe ; but interferes with progression, and slightly with speech. She complains of severe headache ; and her temper is irritable.

Elic. Scintillæ Electricæ spinâ dorsi.

Pulv. Rhei c̄ Cal. gr. xij. p. r. n.

The sparks were drawn off, at the distance of three-eighths of an inch, till the peculiar eruption was produced. After the fourth or fifth trial, the articulation became distinct, and the walk almost quite steady : there were still, however, twitchings in the arms, shoulders, and muscles of the face. At the end of the third week they had all entirely ceased, in the order above enumerated. Two doses of the rhubarb and calomel had been administered during this period.

CASE 3.

WILLIAM SUTTON, aged 14, a healthy-looking, but rather small boy, admitted into Lazarus' Ward, under Dr. Cholmley, on May 10th. He states, that he has been thrice affected with chorea ; the first attack occurring upon fright, caused by a vicious horse pursuing him. For this attack he was admitted into this hospital, under Dr. Back ; and having remained under treatment six weeks, left, cured. Twelve months subsequently he again became the subject of chorea ; which, although of longer duration than the former attack, was much less violent. He was then placed under Dr. Bright ; and again left the hospital, apparently quite well. In the commencement of the present year, he suffered from a third invasion of the complaint, which he describes as of a more serious character than either of the former. At present, he is unable to remain quiet a moment : he can walk, but his legs bend about frequently, while he is doing so. He is continually thrusting his hand along his side. The face is more violently affected than other portions of the body.

Zinc, with purgatives, was administered, but with little benefit, till June 19th ; when, upon his coming under Dr.

Addison's care, electricity was ordered to be applied daily along the spinal column. This plan was persevered in till July 11th; when every symptom of chorea having disappeared, and his general health being good, he was presented.

CASE 4.—Hysterical Paralysis.

MATILDA SIMMONS, aged 16, of delicate appearance, light brown hair and eyes, mammæ well developed; has been at service in London; and previous to the appearance of the catamenia, a twelvemonth ago, she experienced the ordinary symptoms attending a delay of that function—head-ache, palpitation, shooting pains, &c.

For six months, the catamenia appeared regularly; cold then occasioned their arrest; and the former symptoms recurred, and were soon accompanied with numbness and coldness of the whole of the left side. This was immediately preceded by a fit; which, from the account of the friends, appears to have been of the truly hysterical character. Ten days before admission, the face, which had hitherto escaped, became numb on the left side, the sight of the left eye became dim, and there was a slight pain in the globe. On the third day there was perfect anastrosis and ptosis. At the time of admission, there was numbness, coldness, and deficient muscular power over the whole of the left side, including the lining membrane of the mouth, nostril, and conjunctiva: in the latter she perceived a burning sensation, but could not appreciate a touch: the pupil was contracted, and not at all obedient to light: she could not raise the upper eyelid. She complained of pain in the head, and giddiness. Bowels torpid.

C. C. Nuchæ.—Emp. Lyttæ postea.

Mist. Magnes. c̄ Magnes. Sulph. et Tinct. Jalapæ, ʒi. t. d.

This treatment was continued for some time, without the slightest benefit.

April 24. Dr. Addison ordered electricity, in the shape of sparks, down the spinal column. On the same evening she could bend her fingers; and the 27th recovered, to a certain extent, power over the muscles of the arm.

29. The third application was made yesterday ; with the result, of restoring vision, and the power of elevating the upper eyelid, increasing the power of the arm, and improving, to a certain extent, motion and sensation in the leg.

May 4. Improvement continues : she can walk without difficulty ; experiences no numbness, but complains of tingling in the fingers of the left hand : the left eye remains as when she was admitted.

June 12. The form of electricity has, during the last ten days, been changed ; sparks being drawn from the left eyelid, and shocks passed through the uterus. There is no improvement in the eye, which remains perfectly amaurotic ; but the catamenial function was restored yesterday morning, not preceded or accompanied by any particular symptoms. Her general health being good, she has left the hospital at her own desire.

CASE 5.

ANNE BOSHER, aged 21, a stout, short girl, of rather heavy expression, with dark hair and eyes. Her own health, previous to her present illness, had been always good : her family, however, is not a sound one, cerebral diseases afflicting several members of it : a sister has had chorea, but she has no recollection of it. At the age of 16, she lost her mother, which affected her seriously ; and about that time a large abscess formed under the left inferior maxilla, which remained some time open, and discharged freely. The catamenia then appeared ; and continued regular, in their recurrence and quantity, till the age of 19, when she was suddenly seized with severe pain at the posterior part of the head, accompanied by loss of recollection. A medical man was called in, who used very large depletion. After confinement to bed for six weeks, this attack yielded ; but she was left excessively languid, with severe pains in the loins and right leg, irregularity in the catamenial discharge, and diminished muscular power. Some weeks subsequently her right hand became affected with involuntary twitchings, which gradually extended themselves to the whole body, but more particularly to the right side ; and at length her agitation was so violent,

that straps were required to keep her in bed. Speech and deglutition were greatly impaired, and the muscles of the face and eyelids were in constant action. She had no fit during this period, but the headache was distracting. Medical aid was procured, but to no purpose. She was then admitted into St. Thomas's Hospital; and while there, experienced some sharp epileptic attacks. She remained in that hospital nearly ten months; and then quitted, not much benefited; although at one time she had greatly improved. She was immediately afterwards admitted into Charity Ward, at which time she could with difficulty be retained in bed: she could not walk or, indeed, even stand; neither could she remain quiet for a moment. Her epileptic seizures were frequent and severe: recollection impaired: deglutition and articulation imperfect: the right side is now, and has been always, more seriously affected than the left: headache, with pain in the back and loins. In this state she continued, with very slight improvement, in spite of a host of remedies, comprising cold to the head, blisters and cupping to the spine, drastic purgatives, iron, zinc, and many others.

June 12. Electricity daily, over the spine, was prescribed; the bowels to be regulated by occasional purgatives.

This treatment has been steadily persevered in (being only once or twice interrupted by her fits), and with very evident benefit. The catamenia have re-appeared, although only for a few hours: her headache has considerably decreased, and her memory improved: the fits seldom trouble her, and her muscular power is so much restored, that she can not only walk about the ward without assistance, and without much difficulty, but can carry, without spilling the smallest quantity, a cup pretty full of liquid. There is still, however, a little twitching of the extremities; and the right side remains yet more agitated than the left. The treatment is ordered to be continued.

CASE 6.—*Chorea.*

SARAH KIDD, aged 16, tall, of slight make, dark hair and eyes, swarthy complexion, prominent eyes, and fatuous aspect, admitted Feb. 18th, 1837, into Miriam Ward.

Her family are all suffering from derangement of the nervous centres. One is blind; two epileptic; another, both idiotic and blind. She has always been weakly. The catamenia appeared twelve months ago, preceded by considerable pain; but were arrested in about two hours, by some one in disguise alarming her. They have never appeared since, either naturally or vicariously. Immediately after their cessation, symptoms of chorea came on. The irregular and involuntary motions chiefly affected the neck and face. These increased, so that the straight jacket was employed, to keep her in bed. Violent muscular agitation, frequent headaches, loss of articulation, and impairment of deglutition, continued for five months, in spite of medical treatment, which chiefly consisted of leeches to the temples and spine, and the use of the shower-bath. Twice during this period she had severe aggravations, lasting three or four hours; during which it was with difficulty that three or four persons kept her in bed. At the end of five months she could walk about, but the twitchings never ceased. The shower-bath was persisted in, till the occurrence of an attack of acute rheumatism.

A fortnight ago, without any assignable cause, the twitchings became more vigorous. At present, the aspect is fatuous, though occasionally wild, and almost maniacal; the symptoms of chorea are well marked and severe; the pupils are dilated; eyesight dim; sweating profuse.

Pulv. Rhei c̄ Cal. ʒi. statim.

Zinci Sulph. gr. i. t. d.

Pil. Aloes c̄ Myrrhā ʒi. alt. noctibus.

The symptoms remained obstinate. Colchicum in powder was given as a purgative, and continued for some days after the peculiar pea-soup motions had been induced. Valerian and iodide of iron were not more successful.

April 20. Electricity was commenced. Sparks were drawn from the spine, and shocks passed through the pelvis.

29. The sparks induce a variegated eruption, without papulæ, her skin being thick. There is much less twitching of the shoulders, and the hands are more steady. Muscæ

volitantes still float before the eyes. She looks more cheerful, and feels, generally, better.

May 2. Is rapidly improving. She can now walk several steps without falling. Each electric shock produces intense muscular spasm.

Within a day or two from this date, all traces of involuntary muscular action disappeared: her gait, however, remained stiff and ungainly. This was explained by the anatomy of her knees; the patellæ being ill developed, not above a third of their natural size, and seated several inches above their natural position. Very slight flexion is possible; and the attempt causes pain. The dimness of vision and muscæ volitantes have quite disappeared.

20. Presented, quite cured.

CASE 7.—Chorea treated by Electricity.

FRANCES SHEAD, aged 12, an active and intelligent girl, of moderate height and stoutness, admitted April 12, 1837, into Miriam Ward.

She has undergone most of the ordinary diseases of childhood; and, without any very apparent cause, has frequently suffered from headache, chiefly confined to the occipital region. During the last three months, this symptom has increased; and she has likewise experienced nocturnal pains in the eyes disturbing her rest, dimness of vision, and muscæ volitantes. The catamenial function is not developed.

On the 24th of March, she was much alarmed by a cat flying at her; and from this period her friends can date slight irregular movements of the hands. These continued for about a week: a paroxysm of pain in the head then occurred, confined to its old spot, and so excessive, that she threw herself down and screamed violently. This ushered in increased muscular agitation, not confined to the arms, but affecting the whole body; progression became difficult; articulation and deglutition much impaired; respiration difficult and laborious; the expiration being attended with a snorting sound.

At present, these symptoms are in full force. The countenance is vacant; there is headache, pain in the right ankle and wrist, general and continued muscular spasm, affecting both sides equally, but most intense in the arms, shoulders,

and face. The tongue is broad, slightly furred; its muscles under no controul. Pulse 100, feeble: appetite good. A slight "bellows' sound" is audible over the root of the aorta. Upon the neck and back a number of furunculi are forming, apparently owing to stimulating applications which have been used before her admission.

Scammon. gr. v. Hydr. Submar. Sacchar. aa gr. iifs. stat. et alt. auror.
Zinc Sulph. gr. i. Ext. Conii gr. ii. t. d. in forma pil.

April 17. It was necessary to administer the zinc in solution, owing to her inability to swallow any thing solid. Articulation is now quite inaudible. The furunculi continue to form; and, when opened, discharge pus, and sloughing cellular membrane. During sleep, which is not much disturbed, there is slight twitching of the fingers. Increased pain and convulsion come on in paroxysms.

20. The zinc has been increased to eight grains thrice a day, without the slightest benefit. Dr. Addison now ordered electric sparks down the spine, every other day.

28. The electricity has been administered four times, and with marked benefit. It is continued each time for about ten minutes, until a vivid eruption appears, closely resembling lichen urticatus, though scarcely so much raised. She can now project the tongue, though only for an instant, and articulate audibly; deglutition is more comfortably performed; she can sit in a chair, and even stand for a short period. The pain in the head is diminished.

May 6. She can now walk without difficulty, and stand on one leg for a short time. The shoulders, arms, and tongue are now the most affected.

12. The electricity is still continued, and the improvement is uninterrupted. She can now walk, without exhibiting any irregular movements. The countenance has entirely lost its fatuous expression. She cannot keep the tongue protruded.

31. Presented, quite free from all traces of chorea.

August. Again admitted under Dr. Bright, with a very mild attack of the disease, not sufficient to interfere with her ordinary pursuits. The sulphate of zinc was ordered; and she left, cured, in less than twenty days.

CASE OF DISEASE IN THE FŒTUS.

BY MR. T. W. KING.

IMPERVIOUS URETHRA; ACCUMULATED URINARY SECRETION; DILATED
URETER; BURSTING OF THE DISTENDED BLADDER; PERITONITIS AND
ASCITES AT THE FOURTH MONTH OF FŒTAL LIFE.

THE rarity of the following case*, the plain and simple pathological explanation of events, and the probable physiological inference of fœtal secretion, have led me to consider these particulars as fully worthy of being recorded; and I have been at some pains to render them accurate, though it has not been in my power to make them in all respects complete.

Mr. Nathaniel Coats presented to the Museum a fœtus, the subject of the present history. Having seen a good deal of practice, he was struck with the unusual appearances when the case occurred; and preserved the specimen very carefully, with the view to its being made available in the illustration of disease. The following are the principal particulars, which he related to me from memory, con-

* I have not found any precisely similar history detailed; but I would venture to remark, that more general and careful observations of fœtal morbid anatomy might explain many of that class of abortions which do not originally depend on the mother. There are some cases which appear of a doubtful class. Two cases occurred, under my own observation, within a few days, which seemed easily explained. In one, it appeared that the fœtus had been expelled at the os uteri, through a little fissure in the ovum, which subsequently came away otherwise entire. The umbilical cord was torn across in the aperture. This, which I believe to be a common event, occurred about the sixth week. In the other case, at about the second month, a simple decollation seemed to have been effected in a similar manner. The head came away perfect; but the remainder was dissolved by decomposition, with much delay, and fœtid discharge.

cerning the circumstances of the mother, who was under his care, in the neighbourhood of the Nanty-Glo Iron Works†.

Mrs. Morgan, 27 years of age, of a somewhat strumous appearance, and menstruating at all times irregularly, had been married eighteen months, when she became pregnant for the first time; but although the catamenia were absent, she was not aware of her condition. She appeared to suffer from peritonitis at an early period of her pregnancy, and subsequently continued more or less ailing and delicate. A premature parturition was preceded by an attack closely resembling peritonitis, for which she was actively treated. The patient had not supposed herself to be with child, until the time of her delivery. The fœtus was born dead, with a full hydropic belly. Nothing else of an unusual nature was observed: the mother recovered naturally.

The fœtus had been preserved in spirits about three months, and was brought to me in good condition. It was of the male sex.

Its age was, perhaps, more than four months; and besides the distention of the abdomen, there was no evident deviation of the external form. The ascitic cavity had become flaccid; but probably contained, when first observed, about a quart of fluid. Its parietes were very considerably distended and attenuated, notwithstanding some œdema which affected the surface together with the umbilical cord.

On opening the cavity, I found the fluid opaque, viscid, and of a dusky reddish colour, with numerous soft flakes of fibrinous matter floating in it. The natural gloss of the peritoneum was a good deal destroyed; and the surface was in parts slightly coated, as with fibrine. The liver was reduced, and had become much rounded in figure: its tunic was opaque, and somewhat thick. With this organ the bowels were collected into a bunch, in the middle of the superior part of the abdomen. The bladder was large; and extended to the umbilicus, without any appearance of a distended urachus. It may have contained, originally, rather more than half a pint of water. Its coats were decidedly thick; and when the dilatation is considered, they

† Monmouthshire.

may be said to have been much hypertrophied. The lining membrane did not appear materially changed, in other respects. The general figure of the sac was globular, with a little call reaching into the prostate, as if it were the commencement of an urethra. Beyond this there was no excretory canal. The penis was perhaps rather small, but seemed otherwise well shaped. A perforation was found a little behind the summit of the bladder, around which the vesical tunics were very much reduced, as if by absorption from the pressure of distention. This ruptured opening of communication from the bladder into the peritoneum was a simple fissure, rather less than half an inch in length; and its margins were extremely thin.

The ureters were enlarged, chiefly inferiorly, and much beyond the capacity of these canals in the adult. They were tortuous, and somewhat thickened. Their vesical terminations were more natural. The kidneys were small, and somewhat lobular, and not materially affected by pressure within.

The rectum and anus were well formed: the large intestines contained but little meconium. The testes were somewhat flattened, loose, and slight: they were situated within the internal abdominal rings. The spleen and stomach were small. The supra-renal bodies, and the contents of the chest, were fairly developed.

There are some remarks which naturally arise out of the consideration of the preceding case, but which it will not be necessary to do more than advert to at this time.

I have supposed that cases more or less resembling the above may prove to be not very uncommon: at least, I should rather anticipate that dissections more frequently performed may bring to light frequent analogous instances.

The present case seems to have been protracted to a late stage of disease, and one that would be very remarkable in the adult.

My friends, Dr. Hodgkin and Mr. Edward Cock, have informed me of the case of a fœtus, which they examined together some years back, in which there was a similar dilatation of the bladder, from accumulation.

Now, it is of course sufficiently well known, that all the consequences of urinary obstruction which have been related above also occur in adult persons; but, in reflecting upon the instance before me, there appear to be some peculiarities highly deserving of notice. I shall advert to them according to the order in which they may be supposed to have arisen, as to time.

We cannot doubt that a certain secretion is effected in these cavities during foetal life: hence, the importance of an urachus, and its appendages, in certain animals. At the same time, we may observe, that the absence of any notable urachus on this occasion seems to indicate its small importance, or rather it implies a totally different arrangement in the human economy.

The appearances which I have detailed would imply an exceedingly slow process of accumulation. The yielding, together with the thickening, which had taken place in the urinary passages must have required a very considerable time in which to become completed: the nature of the opening of extravasation is also perfectly characteristic of a gradual change: and the same applies to the Case which was dissected by Mr. Cock.* The result is closely analogous

* In the Medico-Chirurgical Transactions, Vol. XIX., Dr. Robert Lee has presented some facts resembling the present history, in order to illustrate the function of the kidneys before birth.

His Paper consists, First, of the history of a child born at the eighth month; with a double hare-lip; clubbed feet; and an enlarged abdomen, in consequence of obstruction in the ureters, and of accumulation in the renal pelves (to the amount of ℥iv. on one side, and ℥ix. on the other) of a fluid, which Dr. Prout decided to be of an urinary nature, to contain lithic acid, and to have a specific gravity of about 1.012.

In the Second place, it is related, that pure liquor amnii, drawn off at the sixth month, was of a straw colour, sp. g. 1.010, neither acid nor alkaline, and devoid of any trace of urine or uric acid.

Thirdly, Mr. Howship's Case is introduced.—A male was born alive at the eighth month, and died in a few hours. It had distorted feet, and imperforate anus. A quarter of an inch of the urethra, near the bladder, was impervious. The bladder contained seven or eight ounces of clear limpid urine; and its coats were extraordinarily thick, but had yielded posteriorly, so as to form a pouch. The ureters were as large as the finger, attenuated and contorted; and the kidneys resembled a congeries of small hydatids, no larger than garden-peas, loosely connected together by cellular membrane. There was no visible remain of, nor any appearance at all resembling, the natural structure of the kidneys; yet, from considering the appearance, it

was

to the effects in the adult, not where the retention is complete, but where it is partial and long continued.

I have remarked upon the late stage of progress to which the fœtus had survived, namely, a severe and inflammatory ascites of considerable standing, as evinced by the contracted liver and general state of the cavity and its contents: and the inference which I would draw from these indications, is, that the urinary secretion must be much less irritating than in after-life. After birth, such an extravasation is fatal within a day. In the case in question, if the vesical rupture had produced the ascites, which I can hardly doubt, this last must have existed for several days subsequently.

The case under consideration seems to shew, also, that micturition is naturally performed in ovo; that is, as far as could be seen, the obstruction to the discharge was the only original defect, and the prime cause of all the visible disease*.

was clear, in my opinion, they must have continued to secrete urine till the patient died.

Fourthly: It is stated, that Dr. Ivanove, of St. Petersburg, "had dissected a child, born at the full time, who lived forty-eight hours, with the urethra imperforate, the bladder much and the ureters still more distended."

Fifthly: Sir B. Brodie had seen a nearly full-grown male fœtus with the orifice of the urethra congenitally deficient, and the bladder, ureters, and renal pelves, all a good deal distended by a fluid which Mr. Brand found to have the other properties of urine, but no uric acid.—(*A Treatise on Urinary Complaints*, &c., by John Howship, 1823.)

Sixthly: A case is quoted from M. Billiard of a child who died a month old, *hydrocephalic*, with one imperforate ureter, and the corresponding kidney as large as a goose's egg, forming a multilocular cyst without remains of renal substance.—The opposite organ was hypertrophic.

Another case is given from M. Billiard of a still-born male with an enormously distended bladder. The internal, not the external orifice, was closed. The ureters became greatly enlarged upwards; and each kidney was nearly as large as a hen's egg, lobular, cystiform, and covered with cortical substance.

Lastly: There is a sketch, by Mr. Wilson, of a child who lived a quarter of an hour, in whom the kidneys were as large as a man's fist, gone entirely into hydatids (cystiform dilatations), the ureters exceedingly convoluted and dilated, and the bladder prodigiously enlarged.

* The waters of the amnion and allantois have been analyzed by numerous investigators. Vauquelin makes the sp. g. of the human liquor amnii 1.005, when freed from its insoluble matters: and he agrees with Bostock in stating the soluble contents at less than 2 per cent. These statements

We may well imagine that the modified means of nourishment, and restrained functions of foetal life, should require a less complete, or considerable urinary excretion: and the copious cutaneous elimination may compensate for this, whilst its sebaceous nature may serve to shield the delicate surface of the body from whatever is offensive in the waters of the amnion.

statements are given by Berzelius, without reference to the period of gestation.

Frommherz and Gagert discovered, besides animal substance, ammonia, and benzoic acid, and, as they think, urea; and also muriate, phosphate, sulphate, and carbonate of soda, sulphate of lime, and salts of potash.

According to Dr. Prout, the amniotic fluid of the cow, in the early part of gestation, contains,

| | |
|--|-------|
| Water | 97.70 |
| Albumen | 0.26 |
| Alcoholic extract and lactates | 1.66 |
| Watery extract, sugar of milk, and salts | 0.38 |

100.

This examination would indicate, as Berzelius remarks, that this fluid is a source of nourishment to the fœtus.

The fluid in the allantois of the cow, "that is," says Berzelius, "the urine of the foetal calf, has a sp. g. between 1.003 and 1.0295 (varying still more, perhaps, according to the age of the fœtus). It no longer contains any considerable quantity of albumen; but it affords the extractive matter, and the salts of urine, with a peculiar acid, the allantoic, which was the discovery of Vauquelin (*Traité de Chimie, par J. J. Berzelius, traduit par Esslinger. Paris.*) It is not unworthy of attention—if the Wolfian bodies are possessed of different canals in connection with the genito-urinary passages, as has been supposed—that the obstruction of these passages produced no apparent impediment to the absorption of those provisional foetal organs. We might regard this fact, if it shall be corroborated, as indicating rather that the bodies in question are analogous to those which have no excretory canal, but lymphatic vessels; and which are, in truth, organs of perfective assimilation; as, the thyroid and thymic glands.

ON THE
THE DISTRIBUTION AND PROBABLE FUNCTION
OF THE
SUPERIOR AND RECURRENT
LARYNGEAL NERVES ;

AS DEMONSTRATED, BY DISSECTION, IN THE HUMAN SUBJECT.

BY MR. JOHN HILTON.

CONSIDERING the following description of the two laryngeal nerves not merely a record of my opinion, but a statement of facts acquired from repeated and careful dissections of my own, I do not deem it essential to its interest or importance that I should attempt to expose the probable causes of the various and discrepant opinions already published in reference to their distribution ; and the consequent deductions, both physiological and pathological.

I shall, moreover, confine myself to those portions of the two nerves supplying the parts which are connected directly with the integrity of the larynx and the vocalization of the air : hence I need not allude to the superior laryngeal nerve, until we arrive at the part where the crico-thyroid branch* separates from it : and I shall avoid, as foreign to my present purpose, a detailed description of the relative position, the nervous communications, or the branches of the inferior or recurrent nerve, until we approach the middle of the trachea.

* Vide Sir Astley Cooper's and Mr. Cock's Observations on the Origin of the Superior Laryngeal Nerve, in this Number of our Hospital Reports, p. 311.

The SUPERIOR LARYNGEAL NERVE, after detaching from its fibrous sheath the crico-thyroideal† branch of the pneumogastric, traverses the fibrous tissue occupying the interval between the thyro-hyoideal round, and the thyro-hyoideal broad ligaments: here some filaments are thrown into the cellular and fatty tissue investing the nerves and surrounding parts; after which, the distribution may be systematized into, 1. Ascending; 2. Transverse; and, 3. Descending.

1st. The ascending branches are from eight to ten in number: some of them take their direction upwards, forwards, and outwards, to the lateral fræna of the epiglottis, and the tissue immediately below the tonsil gland, where they are lost. Others pursue their course upwards and inwards, towards the epiglottis: they first pass rather on the glossal aspect of its margin, where some of them terminate; whilst the majority either perforate the epiglottis, or cross its margin in deep fissures, and are then very minutely distributed to the mucous membrane, submucous cellular tissue, and glands covering its laryngeal aspect.

The 2d, or the transverse filaments, enter the aryteno-epiglottidean folds; where two of them follow the transverse direction, and supply the cellular tissue at the anterior part of the root of the epiglottis; and then pierce it, to supply the laryngeal aspect of the same part of the epiglottis. Two or three small filaments of this transverse division of the nerve ramify amongst the glands; and appear to supply them, at the summit of the external wall of the pouch, which I discovered, and have described in this Number of our Hospital Reports. Other filaments of the same transverse series cross over the upper part of this sac; then descend, inclining forwards and inwards, to the anterior part of the rima-glottidis: some of them supply the anterior and inner aspect of the sac, the glands upon it, and the mucous membrane on the superior chorda vocalis: the others, having arrived at the anterior angle of the rima

† The crico-thyroideal nerve gives some branches to the inferior constrictor of the pharynx, and terminates by expanding in the crico-thyroideus muscle. Besides these muscular branches, there are two long filaments extending downwards between the thyroid gland and the œsophagus, to join the inferior or recurrent nerve.

glottidis, near the apex of the epiglottis, communicate, in the median line, with the corresponding filaments from the opposite nerve; and some fibrils can be traced to the anterior extremity of the inferior chorda vocalis.

The 3d, or descending set, or rather branch (for the filaments comprising this series continue congregated into one chord for more than half an inch, and then diverge), is contained in the posterior part of the aryteno-epiglottidean fold, following its direction to the outer side of the arytenoid cartilage; when one filament continues vertical between the mucous membrane and crico-arytenoideus, and communicates with the posterior branch of the recurrent nerve. Several filaments are lost in the submucous tissue covering the arytenoid cartilages, and also that, between them both, on the laryngeal and pharyngeal surfaces; the latter, as far as the lower edge of the cricoid cartilage. There are two filaments which wind round the external edge of the arytenoid cartilage, and enter the upper part of the arytenoideus-transversus muscle: one of these, the smaller, joins the recurrent filament to this muscle; the other curves round the posterior and internal edge of the arytenoid cartilage, and then, descending along the inner side of its base, obliquely downwards and forwards, is distributed, by minute fibrillæ, upon the inferior chorda vocalis and the membrane lining the internal surface of the cricoid cartilage.

THE INFERIOR OR RECURRENT NERVE, after winding around the subclavian artery* on the right side, and the transverse portion of the aorta to the left side of, and in contact with, the remains of the ductus arteriosus—and having formed, on either side, numerous communications with some of the nerves supplying the heart and lungs—lies in the lateral groove between the trachæa and œsophagus. It yields many branches to the muscular walls of the œsophagus, a few to the cellular tissue between the thyroid gland and the

* In our dissecting-room, last winter, we had a subject, in which the right subclavian artery came off from the posterior part and left side of the transverse portion of the aorta. In that case, the right recurrent nerve did not curve round the artery, but was detached from the pneumogastric at an acute angle with the descending part of the nerve, about opposite the fifth cervical vertebra.

trachea, and supplies freely the transverse inter-cartilage muscles of the trachea. About opposite the tenth ring of the trachea it sends a long and slender filament upwards behind the lateral lobe of the thyroid gland, to join a descending filament from the crico-thyroideal branch of the superior laryngeal nerve. Rather more than an inch below the cricoid cartilage, the nerve continuing in the groove between the lateral surfaces of the œsophagus and trachea, it divides into two branches, an anterior and a posterior. The posterior and smaller sends filaments to the upper and posterior part of the œsophagus, and to the lower part of the inferior constrictor of the pharynx. One, and sometimes two, of these filaments to the constrictor communicate with crico-thyroideal filaments of the superior laryngeal nerve, supplying the upper part of this constrictor muscle. The continuation of this posterior branch having traversed the interval between the cricoid origin of the inferior constrictor and the œsophagus, terminates in two filaments; one going to the internal aspect of the pharynx; the other, passing to join the long descending filament of the superior laryngeal nerve between the crico-arytenoideus posticus and the mucous membrane of the pharynx covering it.

The anterior and larger terminal branch of the recurrent nerve perforates the inferior constrictor of the pharynx; then rests, covered by mucous membrane, upon the posterior part of the crico-thyroideal articulation, in a groove between the inferior cornu of the thyroid cartilage and the crico-arytenoideus posticus, to which muscle it sends four or five filaments: one of them passes obliquely upwards between this muscle and the cricoid cartilage; crosses the upper edge of the cartilage; then enters the arytenoideus transversus, supplies it and the arytenoidei obliqui, and joins in the transverse muscle a corresponding branch from the recurrent of the opposite side, and a branch of the superior laryngeal, which I have already alluded to in the description of that nerve. The further distribution of the recurrent nerve is by separate filaments, which enter, on their external aspects, the crico-arytenoideus lateralis and thyro-arytenoideus muscles. Two of the fila-

ments which pass into the last-mentioned muscle go through it to its upper edge, and supply the aryteno-epiglottideus, superior and inferior; the inferior being the muscle which I was the first to notice specially.

In conclusion, I think we may abstract from the preceding facts two highly interesting and extremely important inferences: 1st, That the superior laryngeal nerve is a nerve of sensation; because, independent of the crico-thyroideal nerve—for an explanation of which I must refer to Mr. Cock's Paper on this subject—it is distributed exclusively to the mucous membrane, cellular tissue, and glands. 2dly, That the inferior or recurrent nerve must be the proper motor nerve to the larynx; as it alone supplies all the muscles which act immediately upon the column of air passing to and from the lungs.

DESCRIPTION
OF THE
SACculus OR POUCH
IN THE
HUMAN LARYNX.

BY MR. JOHN HILTON.

IN this very short and incomplete account of what I must denominate my Laryngeal Pouch, I shall confine myself to the consideration of its natural character, in form and size, in the adult human subject; without noticing the different conformations, varying with the sex, age, and some peculiarities of voice, in man and in other animals. I intend, very shortly, to bring forward the whole subject, in a more extended form, embracing the physiology.

My observations upon the pathology of this laryngeal pouch are not numerous enough, or sufficiently exact, to allow of their publication at present: but with the very vast opportunities which our Hospital and Museum offer, the subject cannot long remain in doubt.

To obviate much of the existing confusion and misapplication of terms employed in various anatomical descriptions of the larynx, I would suggest, for general adoption, the nomenclature which I shall employ in this account of the larynx. The superior opening of the larynx I shall call aryteno-epiglottidean, from its position; the inferior aperture between the inferior chordæ vocales, the rima ventriculi laryngis; the large or general cavity of the larynx, into which these open, ventriculus laryngis; the depression between the superior and inferior chordæ vocales, on each side, the fossa elliptica ventriculi; and the pouch I shall describe as the sacculus laryngis, or true laryngeal pouch, which terminates below, upon the fossa elliptica.

There are also two other depressions in the ventricle of

the larynx, one on each side of the epiglottis, between its edge and the superior chorda vocalis: these depressions I term the fossæ superficiales ventriculi. Into these fossæ superficiales, the submucous glands, arranged on each side, at the edge of the epiglottis, pour their secretion.

The laryngeal pouch is found extending upwards, on each side, from the fossa elliptica or space between the superior and inferior chordæ vocales, interposed between the internal surface of the ala of the thyroid cartilage and the ventricle of the larynx, terminating below upon the fossa elliptica, and bounded above by a large quantity of fat; and its superior part is crossed from behind, forwards, by the aryteno-epiglottidean folds. The pouch averages about half an inch, or more, in height; and if distended, reaches the upper edge of the thyroid cartilage. Its shape is not always the same: sometimes it is nearly conical, with its base placed inferiorly; sometimes pear-shaped, with its broader part superiorly; occasionally nearly cylindrical, and generally curved upon itself slightly backwards.

The opening into the fossa elliptica is nearly oval, when the chordæ vocales are stretched backwards by traction made upon the arytenoid cartilages: but if these parts be relaxed, it then assumes a more circular shape.

The opening of the pouch is provided with two small semi-lunar folds of membrane, placed anteriorly and posteriorly with respect to the centre of the aperture. These folds are not exactly of the same elevation: the anterior is about a line superior to the posterior; but both crescents present their concave edges towards each other.

An extension of the pulmonary mucous membrane entirely lines the pouch: this is perforated by very numerous and minute openings, the terminations to the excretory tubes from the glands which surround and belong to this pouch, pouring their secretion into it. Nearly the whole of the exterior of the pouch is surrounded by a peculiar fat, which conceals from view the glands proper to the sac. This fat probably plays an important part in the regulation of sounds produced in the larynx, by arresting vibration.

The muscle delineated on the laryngeal aspect of the pouch, in Figure 3, is now, I believe, for the first time

noticed. I shall term it the aryteno-epiglottideus inferior, to distinguish it from that hitherto called the aryteno-epiglottideus; which having a superior position, must now be denominated the aryteno-epiglottideus superior. These two muscles are separated by a distinct cellular interval, and some filaments from the superior laryngeal nerve.

The *aryteno-epiglottideus inferior* is easily brought into view, by taking off the mucous membrane of the ventricle of the larynx, immediately above the superior chorda vocalis, with a few small mucous glands which open upon it, some cellular tissue, and a few filaments of the superior laryngeal nerve: the muscle will then be seen passing from the arytenoid cartilage to the lower part of the epiglottis.

The muscle arises, by a narrow and fibrous origin, from the arytenoid cartilage, just above the arytenoid attachment of the superior chorda vocalis: it passes forwards and a little upwards, and, becoming expanded, covers the superior half, or sometimes two superior thirds, of the pouch, on its laryngeal surface; and is inserted, by a broad attachment, into the edge of the epiglottis. The nerve supplying this muscle enters its upper and outer edge: it is derived from the branch of the motor, or recurrent laryngeal nerve, which supplies the thyro-arytenoideus. Its functions appear to be, to compress the subjacent glands, which open into the pouch; to diminish the capacity of that cavity, and change its form; to approximate the epiglottis and the arytenoid cartilage; and it will also have the effect of raising the surface of the fossa superficialis.

Upon removing the aryteno-epiglottideus inferior, we come to a fibrous membrane, which invests the pouch and its glands: this membrane is attached, below, to the superior chorda vocalis; anteriorly, to the edge of the epiglottis; and superiorly, to the upper edge of the thyroid cartilage; thus forming an internal and superior support to the pouch.

After raising this fibrous membrane, and removing carefully the fatty tissue inclosing and concealing them, the proper glands to the pouch are brought into view.

The next muscle I must notice, as capable of acting directly upon the laryngeal pouch, is placed on its external

or thyroideal aspect;—it is, the *thyro-arytenoideus*. Some short fibres of this muscle, immediately after its origin from the thyroid cartilage, are inserted into the inferior and external part of the pouch; and the superior and posterior part of this muscle is not inserted into the arytenoid cartilage, but curves upwards, inwards, and a little forwards, over the pouch (vide Fig. 2.), where it blends with the fibres of the aryteno-epiglottideus inferior.

The glands belonging to, and proper to, the laryngeal pouch* are very numerous: as many as sixty or seventy may be distinguished. I have succeeded in injecting these glands with mercury. It is easily accomplished, in a fresh larynx, by submersing it in water for a few hours; then pressing the water out of the pouch; after which, the pouch is to be filled with mercury, when well-adjusted pressure with the fingers will be sufficient to inject nearly all the glands.

These glands are not all of the same size or form: some are made up of several small lobes; the duct from each lobe terminating in a common excretory tube, which perforates the parietes of the pouch. The larger of these glands are situated at the outer, upper, and anterior surfaces of the pouch; the inner or laryngeal aspect being occupied, generally, by small glands, each having a distinct excretory tube emptying itself into that part of the pouch nearest to it.

The nerves to this pouch (vide Fig. 5) are derived from the superior laryngeal; and are distributed upon its entire circumference, and to the glands upon it. A small drawing, copied from one of my dissections, shewing their arrangement, accompanies this Paper; which renders it unnecessary that I should write a description of them.

On reviewing the position, structure, conformation, and capacity of this laryngeal pouch, no doubt can be entertained of its performing some very important offices, connected, directly and indirectly, with the proper functions of the larynx.

Thus we find upon it two muscles, one upon its external,

* By employing the term "glands proper to the pouch," it will be understood, that I do not include or refer to the glands, hitherto described by anatomists, termed epiglottidean or arytenoidean glands.

and the other upon its internal aspect; both or either capable, during their actions, of diminishing its capacity, and altering the form of the cavity.

I think there can be no difficulty in understanding that the condition of this pouch, whether in a state of distention or in a state of collapse, must influence materially the passing column of air.

The glands belonging to this pouch are placed between it and a fibrous membrane which separates the pouch and glands from the aryteno-epiglottideus inferior. This fibrous membrane is very firmly attached, below, to nearly the whole length of the superior chorda vocalis; anteriorly, to the edge of the epiglottis; and above, to the thyroid cartilage; and must effectually prevent the extension of this pouch towards the ventricle of the larynx, where a projection, from any cause, would interfere with the functions of the larynx, by destroying the arrangement of the particles composing the column of air already put into form at the inferior chordæ vocales.

The secretions from the numerous glands which terminate in this pouch, to supply it, are intended also to lubricate the inferior chordæ vocales with moisture; the surfaces of which must be continually undergoing the process of drying, or be deprived of their moisture by a high temperature and the rapid passage of respired air over them, in its transit to and from the lungs.

The absorption of moisture from the membrane covering the inferior chordæ vocales is undoubtedly increased in proportion to the rapidity with which the particles of air may be moving; and the smaller the aperture, with an augmented *vis à tergo*, or impulse, conveyed by the increased action of the respiratory muscles, the more complete will be this abstraction of moisture. Hence we may understand why the fibres of the thyro-arytenoideus should be so arranged, that whilst they have the power to narrow the rima ventriculi, or inferior opening into the larynx, and thus create a necessity for an additional supply of moisture, they may, at the same time, assist the aryteno-epiglottideus inferior in pressing upon the pouch and glands which, from their locality, are capable of supplying it.

The two semilunar folds of membrane, noticed in the neck of the pouch near its termination, are so arranged, with respect to each other and the opening of the pouch, as to have the effect of breaking the stream of fluid, on its way from the glands to the inferior chordæ vocales; and, by giving it a central direction, they tend to its general diffusion over the surface of the membrane.

There are yet a great number of curious points, connected with this laryngeal pouch and the parts adjacent, which require maturing, and arranging in an extended form: and, as I purpose doing this very shortly, I must not anticipate its interest by any allusion to them in this Paper.

A reference to the accompanying Plate will, I hope, prevent any misunderstanding as to the relative position of the structures described, and assist in rendering the preceding descriptions intelligible to the reader*.

* Some time after I had forwarded, for publication in our Hospital Reports, my Paper on the Laryngeal Pouch, with the Drawings made from my own dissections, I received a note from Mr. James Babington, one of the Editors, informing me, that, after perusing my Paper, he made careful investigations regarding the laryngeal pouch; and ascertained that my description of it had been, in some measure, anticipated by Galen and Morgagni; and also by M. Savart, in a Paper in the *Journal de Physiologie*.

On referring to Morgagni, in his *Adversaria Anatomica* (the book alluded to by Mr. Babington), published in 1741, it is quite evident that the laryngeal pouch was known to him, through the works of Galen;—and in the *Journal de Physiologie*, published in 1825, it is again brought forward.

I must confess I experienced much regret at finding this information; because, up to that moment, I had indulged the belief, and acted upon the opinion, that the whole subject was perfectly and entirely original with myself. I had arrived at that conclusion in consequence of the existence of the laryngeal pouch not having been in any way alluded to, at least so far as I know, by modern authors on anatomy.

On examining the descriptions given by Galen, Morgagni, or Savart, it will be seen that they confine themselves to a very incomplete account, even of the pouch itself; and they make no mention of the valvular folds placed near its orifice, the *proper glands* belonging to the pouch and pouring their secretions into it, the muscles capable of acting upon it directly, its fibrous investments, or the nerves supplying it.

Notwithstanding, I could not allow my Paper to be produced without appending to it the preceding circumstances, in justice to the researches of my predecessors in anatomy;—and yet certainly, I must add, without detracting in the slightest degree from the originality of my own observations and dissections.

J. H.

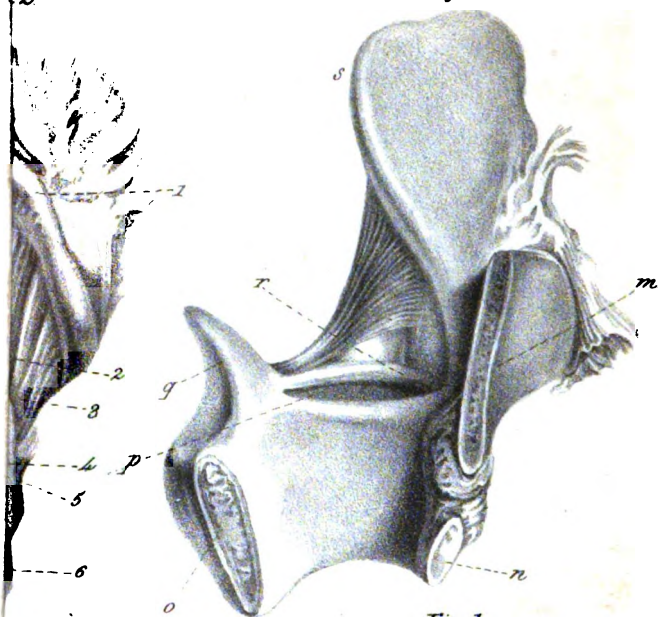


Fig. 1.



Fig. 2.

DESCRIPTION OF PLATE.

Fig. 1.—VIEW OF THE INTERIOR OF THE LARYNX.

- a* Epiglottis.
- b* Aryteno-epiglottidean folds.
- c* Outline of arytenoid cartilage.
- d* Section of arytenoideus transversus.
- e* Posterior section of cricoid cartilage.
- f* Anterior section of the same cartilage.
- g* Section of crico-thyroid ligament.
- h* Section of thyroid cartilage at the median line.
- i* Fossa elliptica.
- k* Sacculus laryngis, or laryngeal pouch, on the right side, with its glands resting upon it.
- l* Left laryngeal pouch cut open, and a bristle passed through the natural opening into the fossa elliptica.

Fig. 2.—LARYNX—RIGHT ALA OF THYROID CARTILAGE TAKEN AWAY.

- 1 Right cornu of os hyoides.
- 2 Section of thyro-hyoid broad ligament.
- 3 External or thyroideal aspect of right laryngeal pouch, covered by its glands.
- 4 Thyro-arytenoideus.
- 5 Section of thyroid cartilage.
- 6 Cricoid cartilage.
- 7 Crico-arytenoideus lateralis.
- 8 Arytenoid cartilage.
- 9 Aryteno-epiglottidean fold.
- 10 Epiglottis.

Fig. 3.

- m* Section of right side of thyroid cartilage.
- n* Section of cricoid cartilage, at the anterior part.
- o* at the posterior or broad part.
- p* Left fossa elliptica.
- q* Arytenoid cartilage.
- r* Aryteno-epiglottideus inferior, vel compressor sacculi laryngis.
- s* Epiglottis.

Fig. 4.—LARYNGEAL POUCH, WITH THE GLANDS AND THEIR DUCTS RAISED FROM THE POUCH.

So far as the glands are concerned, this is to be considered as a sketch of the general character of these parts, rather than an accurate representation of actual size and relative position.

Fig. 5.

- e* Epiglottis.
- f* Right aryteno-epiglottidean fold.
- g* Superior laryngeal nerve, with some of its branches distributed over the inner aspect of the laryngeal pouch, extending as far as the superior chorda vocalis.
- h* Superior cornu of thyroid cartilage on the right side.
- i* Arytenoid cartilage.
- j* A branch of the superior laryngeal nerve curving round the posterior face of the arytenoid cartilage, to supply the mucous membrane at the posterior part of the inferior chorda vocalis and immediately below that part.
- k* Section of cricoid cartilage, posteriorly.
- l* anteriorly.
- m* Section of crico-thyroid ligament.
- n* Filaments of superior laryngeal nerve, supplying the anterior extremities of both chordæ vocales.
- o* Anterior section of thyroid cartilage.
- p* Vertical section of epiglottis.
- q* Laryngeal surface of epiglottis.

ACCOUNT
OF
THE SUCCESSFUL TERMINATION
OF A CASE OF
SPHACELATED INTESTINE AND OMENTUM
IN A
FEMORAL HERNIA.

BY MR. ASTON KEY.

IN the spring of the year 1836, Mrs. P——, aged about 44, consulted me for a tumor in the right groin; which proved to be a femoral hernia, containing a small portion of omentum in an irreducible state, from adhesion to the sac. A hollow pad and truss were recommended, and worn with comfort and advantage; the feelings of uneasiness and of apprehension being both relieved.

In the following October, while staying at a friend's house in the neighbourhood of London, she suddenly experienced in it some pain of an unusual kind, and found it increased in bulk. Mr. Aveline, who was promptly consulted about it, was immediately led to suspect a fresh descent; the bowels not yielding to the action of purgative medicine, and the stomach shewing signs of irritability. Attempts were made to return any recently-protruded viscus, and medicines given to tranquillize the stomach, but without the intended effect. The disposition to vomit increasing, and her abdomen becoming uneasy, she, with reluctance, was persuaded to see me, in consultation with Mr. Aveline.

On closely questioning her as to the time of the tumor's increasing in size, it appeared that it first became uneasy and swelled on the Friday preceding the Monday on which I first saw her, but that for the first twenty-four hours she thought it but of little importance. The disposition to vomit had become constant; nothing had passed the bowels

for four days; and the abdomen was becoming tense, and somewhat uneasy, in the region of the hernia. The tumor itself was hard, and could not bear any pressure. The taxis was, therefore, impracticable; and she refused, notwithstanding Mr. Aveline's urgent solicitations, joined to mine, to submit to any operation. Her sanguine and buoyant temperament assured her that the swelling was not the cause of her illness; and we felt ourselves obliged to yield our opinions to her prejudices, in the expectation that a few hours would convince her of her error. In the mean time, the soothing remedies were continued. Forty hours more, however, elapsed before she consented to have the sac opened; and I was sent for early on Wednesday morning, Oct. 26th, to perform the operation. The symptoms of her disorder had increased; the pulse had risen to 100 in a minute; the abdomen had become harder and more tender; the vomiting more frequent, and of a faecal character; and the tumor more tender, and its coverings inflamed. With the exception of this condition of the sac, there was no ground for thinking that the contents had proceeded to gangrene. Her general appearance was good; the countenance animated; and neither her pulse nor skin shewed any of the ordinary signs of depression that mark the accession of sphacelus.

The inflamed state of the sac and its coverings forbade the attempt to leave the sac unopened. Its contents, therefore, were at once exposed, by the usual incisions through the thickened and matted coverings of the tumor; the foetid odour, that reached us before the sac was opened, plainly indicating the propriety of exposing its contents. A dirty brownish fluid oozed out as soon as it was punctured; and a darkened mass of omentum was discovered, in an advanced state of decomposition. Beneath this was seen a knuckle of intestine, with a patch of sphacelus exceeding an inch in diameter, and without a line of demarcation between the dead and living portions.

To open the dead portion of bowel, and to cut away the gangrenous omentum, would have been in accordance with the ordinary practice under such circumstances. But, before doing it, I paused: many cases, that I had seen followed

by a fatal result, rose to my recollection, and induced me to decide on leaving the process of separation entirely to nature. My reasons for this course were these:—

The practice of making a free incision into the bowel, is recommended with the view of relieving the upper part of it of an accumulated load, for the expulsion of which gangrene has disabled it. Constant vomiting had so far relieved the stomach and intestinal canal, that little good could arise from the incision; nor was immediate relief called for. A distressing state of collapse often follows the free evacuation of the canal by such a proceeding; and I was fearful that it might change her present elastic state to one of depression. It was evident, also, that her powers could well bear to wait for the separation of the slough, and the relief of any fæcal distention.

Strongly in support of the proposition for delay were the results of those cases in which the bowel had been returned in a supposed healthy condition, and subsequently had fallen into a state of gangrene. It has happened to me to see a fæcal discharge from the wound on the second or third day after the operation, in several instances; but without any urgent symptoms of danger, and with, in the end, a favourable issue. By deferring the formation of an opening in the bowel, I was but placing Mrs. P. in such circumstances as I had frequently seen terminate well, and presenting a favourable contrast to the operation of incising the bowel.

It also seemed reasonable to suppose, that if a respite were allowed after the division of the stricture, nature would carry on her process of limiting the gangrenous action, of establishing adhesion, and of casting off the sloughing portion, with more security than if a sudden disturbance of her efforts were to be caused by a more violent mode of proceeding. The stricture being divided, the intestine was gently pressed back toward the abdomen; the major part being left external to the neck of the sac, as a preparative for the ready escape of fæces. The omentum was left in the sac, and covered with a poultice.

The operation was followed by a very slight amelioration of her symptoms. The vomiting continued at less-frequent intervals; the countenance remained the same; the abdomen

was still hard and tender; the pulse was unaltered, either in number or character.

On the 31st, five days after the operation, a discharge of *faeces* took place from the wound; and was followed by some degree of prostration, until brandy and ammonia, with a few drops of tincture of opium, were given: after which, she rallied. The *faeces* continued to be discharged entirely by the wound till the 12th of November, a period of seventeen days. On this day, a few hard balls of *faeculent* matter passed for the first time, from the rectum. An interval of two days elapsed before a second discharge took place; after which a regular but scanty evacuation occurred almost daily.

During the whole period to the 12th, little or no food was taken; and the vomiting continued, especially on any attempt to take food. She was supported by a small quantity of brandy and water; as she was unable to bear the sight of aliment until the *faeces* took their natural course.

After the 12th, the wound, which had been cleared of the sloughing omentum on the 2d, began to close. On the 7th of December it had ceased to discharge any *faecal* fluid, and seemed to be quite cicatrized. On the following day she was seized with nausea; and in the act of vomiting, it was forced open, and discharged a small quantity of bilious matter. It again closed; but in a few days afterwards, in consequence of some indiscretion in exercise, the skin gave way, and a bilious oozing was established for a few hours. The wound then became permanently cicatrized; and she continues well to the present time; wearing a truss, as a measure of precaution.

OPHTHALMIC CASES

OCCURRING AT THE GUY'S HOSPITAL EYE-INFIRMARY.

Reported by Mr. BENJAMIN CARRINGTON.

CASE 1.

JAMES GUINN, aged 28, was admitted into Barnabas Ward, under the care of Mr. Morgan, September 2, 1836. He is a tailor by trade; of a nervous temperament: his constitution appears to be much debilitated, but he says that he has always had good health: his tongue is furred; his bowels are irregular, generally confined; and his appetite is bad. His eyes have been weak for a long period: he had inflammation in them about ten years ago, which continued in a chronic state for six weeks: after this attack, his vision was left so much deranged, that he was unable to follow his employment: his vision has been sometimes better, sometimes worse, during this period; but latterly it has become much worse. About two years ago he was under the care of an oculist; who salivated him, but did him no good. He afterwards had other advice; after which the vision of his right eye was partially restored. At the time of his admission, he had nearly perfect amanosis of both eyes. He complained of pain in his head, and of dark spots floating before his eyes. The structures of the eyes were perfectly healthy, with the exception of slight nebulae of the cornea, the result of prior inflammation. The pupils were dilated, and contracted sluggishly on exposure to strong light. The state of his general health has been stated above. He was ordered,

M. M. c̄ M. S. ʒi. t. d.

Ung. Veratriæ infric. temporibus nocte manequæ.

This plan of treatment was continued, until

Sept. 12, when the following report was made:—His sight has materially improved, under the application of the veratria ointment, and purgatives. He was unable to read, or even to perceive small

print, when first admitted; but he can now read well with his right eye: his left has improved but little: his appetite has improved, and his bowels are regular: he has likewise lost the pain in his head, of which he formerly complained.

16. He has remained stationary since the last report; his sight becoming better or worse, according to the variations of the weather. The veratria ointment has ceased to produce the accustomed effect upon his eyes: his appetite is not good; his bowels are confined; and his constitution generally deranged, owing, probably, to the bad weather now prevailing. He was ordered,

Jul. Rhei comp. \mathfrak{z} i. t. d.

Cal. c Rheo \mathfrak{z} i. statim.—Rep. Ung. Veratriæ.

20. He has slightly improved in his vision: his general health is also much better: his left eye has much improved. He was ordered,

Lotio Nigra pro collyrio.

Ext. Nucis Vom. gr. $\frac{1}{8}$. Jul. Rhei comp. \mathfrak{z} i. t. d.

Rep. Ung. Veratriæ.

30. He has continued the above medicine up to the present time, and has much improved: his vision is more distinct in both eyes; but lately he has complained of fulness of the head, and black spots floating before his eyes. He was ordered,

C. C. Nuchæ ad \mathfrak{z} xij.

Rep. Ung. Veratriæ; et Mist. c gr. $\frac{1}{4}$ Ext. Nucis Vom.

Oct. 6. He is still improving: his head has been much relieved by the cupping: his sight has improved rapidly for the last two or three days, which he attributes to the ung. veratriæ, which has lately excited a much greater effect on him than at any previous time: this is owing to the ointment being freshly made, and of greater strength than the previous parcels.

19. He has continued this plan of treatment, up to the present time, with the greatest advantage. The vision of both eyes has materially improved; so much so, that the patient is able to thread a needle, when it is held in a strong light. His health has become quite renovated; and he is altogether better than he has been for three years.

He was discharged, and ordered to attend at the hospital as an out-patient. He did so for nearly six weeks, continuing the same remedies with decided improvement: he was then discharged; his vision still remaining impaired in a slight degree.

CASE 2.

WILLIAM SHEPHERD, aged 36, was admitted into Barnabas Ward, August 15th, 1836, under the care of Mr. Morgan. He is by trade a blacksmith; stout, plethoric, and sanguine in temperament: his countenance is pale and bloated; his tongue is furred, and his bowels are confined: his appetite is very capricious. He says, however, that he has generally enjoyed good health, but that he has suffered from rheumatism. He has been exposed to the blaze of a large forge for the last six months, almost night and day; and has been very intemperate: for the last three or four months his vision has been getting much impaired. He has giddiness in his head, upon stooping down, and every object which he looks at appears to be covered with a thick mist: he has, likewise, sparks of light occasionally passing through his eyes, when he is in a dark room. The structures of the eyes are healthy in appearance; the pupils are naturally dilated, but sluggish in their motion when exposed to light: the vision was so much impaired, that he was unable to read large print. He was ordered,

M. M. \bar{c} . M. S. \bar{z} i. t. d.

Pil. Plumeri gr. v. nocte maneque.

Ung. Veratriæ temporibus nocte maneque.

Aug. 21. Has somewhat improved under this plan of treatment: his bowels are freely open, tongue clean; has lost the swimming in his head; but his vision is still much impaired, and he is unable to read small print.—Pergat.

Sept. 2. His mouth has become slightly affected by the mercury: just previous to its becoming so, his vision improved greatly; but since the ptyalism has become perfect, no advance in improvement has been made. His bowels are rather irregular, and his appetite is not so good: he was ordered,

Cal. \bar{c} Col. gr. xv. statim.—Cal. \bar{c} Rheo gr. x. bis hebdom.

Rep. Ung. Veratriæ.

14. Has not made much improvement as far as regards his vision: he is still unable to read; but can distinguish the difference between colours, which he was not able to do before: he has lately observed flashes of light before his eyes: his general health has much improved: his appetite is good, and his bowels are regular.—Pergat.

20. Still improving: he now begins to distinguish letters; and is sometimes able to make out a word, if written in large letters: his appetite is good, and his health generally much better than it has been for some time. The ung. veratriæ appears to exert a much greater effect upon him now than it has previously done.—Pergat.

Oct. 1. Has continued the use of his medicines, up to the present time, with great success: he can now read large print: he derives great benefit from the use of the ointment: it occasions a much greater sensation of pricking on his temples, where it is applied, than it used to do; the flashes of light are also more frequent; and in about an hour after he has applied it, he sees considerably better: his health has also gone on improving.—Pergat.

6. Has improved much during the last week: can now read small print tolerably well: still slight confusion of vision remains: his health is better than it has been for some time.—Pergat.

He continued the same plan of treatment up to the 19th of October; when he was discharged, cured.

EXPERIMENTS AND OBSERVATIONS
ON
ALBUMINOUS FLUIDS.

BY DR. BABINGTON.

THE changes which albuminous fluids undergo by a union with the pure alkalies and the neutral salts do not seem to have attracted so much attention as their importance merits. Accident has lately led me to their consideration: and as the facts and inferences at which I arrive appear to possess some interest, I venture to make them the subject of a few remarks.

During an attendance, some months since, on a gentleman who had calculus in the bladder, together with prostatic disease, I had frequent occasion to examine the condition of his urine; which, under the use of acidulated infusion of Buchu, maintained an acid re-action, and was in itself clear and of a natural colour. Towards the end of micturition, however, more especially when first performed in the morning, a cream-coloured opaque fluid was voided; which became mixed with the urine, and ultimately settled at the bottom of the vessel in which it was received. This fluid was not ropy; so that, on decantation, it could be made to flow off, drop by drop; and when thus divided, it appeared to consist of minute flocculi. The application of heat caused an immediate flocculent precipitate; and alcohol, acids, and all such agents as precipitate albumen, had the same effect. On the addition of a moderately strong solution of pure potassa, a remarkable change occurred: the thick creamy sediment became transparent; and was converted, on agitation, into a semi-solid mass, so viscid and tenacious, that, in pouring it from one test-tube to another, a continuous string, several feet in length, could be formed.

This mass I found to be of difficult solubility in water; the mere affusion of that menstruum being wholly insufficient, even after many days' maceration, to alter its character, or abstract the alkali from it. It was, therefore, practicable to wash its surface, so as to free it from any alkaline reaction upon turmeric or reddened litmus-paper. It bore a boiling heat, without losing its viscid consistence or transparency; and remained unaltered, in an open phial, for several weeks. Nitric acid, much diluted, only rendered its surface opalescent; but when added in a more concentrated form, caused a precipitate. Ammonia was equally efficacious as the fixed alkalies, in forming with the urinary sediment a tenacious transparent semi-fluid. This strongly retained the ammoniacal odour; and the compound bore a similarity so striking to natural ropy mucus passed under certain diseased states of the bladder, that I was induced to institute a more minute comparison between them. The opportunity of doing so was afforded me by a case of diseased bladder, with catarrh of that organ, under my care at the same period. The urine in this instance was of a deep colour, and not very clear: it had an ammoniacal odour, was highly alkaline, and deposited a viscid transparent amber-coloured mucus. This mucus was as ammoniacal in its re-action as the urine itself. It was difficultly soluble in water. The caustic alkalies rendered its odour more pungent, but did not affect its viscosity or general appearance. Nitric acid caused a copious precipitation of brown flocculi, insoluble in water. From these characters, this natural ropy mucus seemed to me closely to resemble, if not to be identical with, the artificial combination with ammonia which I had effected, in the first case, by the union of ammonia and the urinary sediment. That sediment I considered to be of a purulent nature; but coming, as it did, from a hidden source, direct proof of this was wanting; and my next endeavour, therefore, was to ascertain whether the same combination could be formed by a union of the pure alkalies with matter from other parts. Fresh pus, from an abscess in the groin, was made the subject of experiment. It was slightly acid; and on the addition of liquor potassæ, just sufficient for saturation, it began

to thicken, and become viscid. A further addition of alkali, brought in contact with it by agitation, effected its complete conversion into a semi-fluid transparent tenacious mass. Solutions of soda and of ammonia produced a similar change; the latter, indeed, in so remarkable a degree, that whilst the pus, when poured into a clean test-tube, was, in accordance with its usual characters, a thick opaque creamy fluid, adhering, as it flowed, to the sides of the glass, on being agitated with liquor ammoniæ it immediately formed a tough transparent semi-solid, which could with difficulty be shaken towards the mouth of the tube at all; but on being caught and contorted as it protruded, the whole was completely brought away, even from the very bottom, so as to leave the internal surface of the tube as clean and free from moisture as before the pus was poured into it. The mucous expectoration in pneumonia will, in the same way, leave the surface of the vessel which contains it. The combination thus formed was very difficultly soluble in water, and retained its viscosity and alkaline qualities in its internal substance, although repeatedly washed: it also preserved its ropiness and transparency, even though surrounded by a weak acid solution more than sufficient to neutralize the alkali with which it was combined. A strong solution of nitric acid rendered the mass opaque; and destroyed its elasticity. Upon the whole, this combination was of the same nature, though more concentrated than that which I had first obtained by the combination of alkalis with the purulent urinary sediment.

As it is often a matter of doubt with the medical man, whether a deposit in urine be of a purulent nature or not, it is a ready test, after pouring off the clear supernatant urine, to add liquor potassæ to the sediment collected in a phial or test-tube. If it be purulent, it will, on agitation, form, with the alkali, the transparent viscid compound which I have described. This I have more than once verified, since my attention was first drawn to the subject.

On diluting and agitating pure pus with four times its bulk of distilled water, the fibrinous particles subsided; and the albuminous fluid, in which they had been suspended, remained dissolved in the water, from which it could be

separated by coagulation, on the application of heat*. The fibrinous particles, thus washed, formed a combination with the alkalis far less tenacious than the pus itself; which led me to conclude that the albumen performed a more essential part in the change than the fibrine. This conclusion brought to my recollection, that many years ago† I had been struck with the result of adding some liquor potassæ to the white of an egg, and thus converting it into a transparent horny solid. The fact being new to me at the time, I searched chemical books, to ascertain whether it had been noticed; and found that Thompson was the only author by whom it had been mentioned. The following are his words:—"When alkalis are mixed with a solution of albumen in water, no apparent change takes place; but if a concentrated solution of pure potash be triturated with albumen for some time, and then allowed to remain at rest, the albumen gradually coagulates, or rather gelatinizes‡; for the coagulum has a striking resemblance to jelly. It gradually hardens; and at a particular period of its drying it resembles very exactly the lens of the eye. When quite dry, it is brittle and transparent." (*Thompson's Chemistry*, Sixth Edit. vol. IV. p. 403.) Considering serum in the light of "a solution of albumen in water"—and I have little doubt that it was serum which Thompson had in his view when he made the remark—I should have been led, from its tenor, to expect that a solution of caustic alkali would produce no "apparent change" in it; and the more so, since it already contains alkali in a free state. The changes produced in pus induced me to doubt the accuracy of the observation; and experiment proved it to be erroneous. Solution of caustic potassa,

* The general notion (see *Turner's Chemistry*, Fourth Edit. p. 932), that pus is insoluble in water, is, therefore, partly erroneous; since the albuminous portion is completely soluble in that menstruum.

† The circumstance is alluded to in some notes of mine, written in 1827, and published in Sir Astley Cooper's Paper in the First Vol. of the Guy's Hospital Reports, p. 451.

‡ The resemblance to jelly is only in appearance; since it wants the most distinctive character of that principle, namely, that of liquefying by heat, and does not pass into a state of acid fermentation. The resemblance to the lens of the eye is also one of appearance only, as the lens is coagulable by heat.

soda, and ammonia, are all capable of converting serum into a thick tenacious fluid, very much resembling that formed by the same agents with pus, but less solid and concentrated. This fact seems hitherto to have escaped observation, from the circumstance that the change is not immediate. "No apparent change," to use Thompson's words, takes place at the moment; but if the fluid be agitated, and then set by, in the course of a few hours, or sometimes even minutes, if the serum be rich in albumen, it will be found thickened, and possessing the same kind of viscosity, though not in an equal degree, as in the case of pure pus. The slight degree of viscosity which serum of blood generally possesses, and the nearer approach to the physical characters of the compound of which I am treating, which is assumed by the albumen of egg, may, perhaps, be owing to the respective proportions of free alkali which they always contain; and their transparency may be attributable to the same cause. Milk, as being another instance of an albuminous solution, was made the subject of experiment, in combination with the alkalies. It becomes, to a certain degree, thickened, viscid, and translucent; the curd, as well as the albumen, entering into the compound, while the cream separates and floats above it. The change is not so striking as in serum, from its containing the animal principles in a state of greater dilution. The term *free* seems correctly applicable to the state in which the alkali exists in these combinations. Its caustic nature is not neutralized; and although it effects so striking an alteration in the physical qualities of pus or albumen, I am by no means certain that it undergoes itself any alteration. May it not be rather considered to furnish an example of that force, noticed by Berzelius, which some bodies exercise over others, so as to produce a change without being themselves affected; and to which he applies the term "catalytic force"? It must not, at all events, be supposed that these combinations are mere solutions—at least, when the alkalies are not highly concentrated; for this supposition would not at all account for the difficult solubility in water, the solidification, or the viscosity manifest in them. Coagulated albumen is an example of an animal substance soluble in strong solutions of

caustic alkali; but the result is, a liquid without any viscosity, from which the albumen may be at once precipitated by an acid, and which is miscible with water, in all proportions.

When the albuminous fluid, whether it be pus or serum, has passed, by the addition of an alkali, into the state of what may be called an artificial mucus, it answers all those conditions stated by Dr. Bostock to be characteristic of natural mucus. It is, as I have said, alkaline in its reaction; and I have found, notwithstanding the assertions of writers on animal chemistry to the contrary, that this is generally the case with natural mucus, provided it be tested when recently secreted. Bibulous paper*, tinged with litmus, and reddened by simple exposure or by a very dilute acid solution, is restored to its blue colour by fresh mucus. A little time is necessary to demonstrate the fact, from the tenacity with which the alkali is held in combination; but it is not the less manifest on this account. Thus, if we take a small pellet of translucent grey mucus (*cra-chats perlés Laennec*), such as many persons in health occasionally expectorate, we shall find, on pressing this between two folds of the reddened litmus-paper, that, although a very slight immediate change of colour is perceptible, yet that, in the course of a few minutes, as the moisture is abstracted from the mucus, its highly alkaline state is rendered evident. In the remarkably viscid mucous expectoration which takes place in pneumonia, and which, with the exception of the air-bubbles it contains, may very exactly be imitated by the combination of pus and solution of soda, I have sometimes failed in demonstrating the existence of free alkali, when the specimen taken for experiment has been several hours saved for inspection; but it has only been necessary to take the product of expectoration at the moment it is discharged, to be satisfied that, when first excreted, it is decidedly alkaline. This will be found to hold generally true of the secretions, not only from what are termed the mucous membranes, such as the nostrils,

* In the shops, they commonly tinge writing-paper for use; but the size it contains, which cannot be soaked out by cold water, diminishes its delicacy as a test.

the intestinal canal, the gall-bladder, and the vagina, but also of such other animal secretions as are ropy and viscid, from whatever source they may proceed. I have already instanced the albumen of egg; and I may add the seminal secretion, affirmed by Vauquelin (*Ann. de Chim.* Vol. IX. p. 65) to be highly alkaline, and the vitreous humor and crystalline lens of the eye. I learn that the constantly alkaline character of mucus has been demonstrated by Mr. Golding Bird, in a Paper read before the Physical Society of Guy's Hospital. That Paper I have not seen; but I can add my independent testimony to that of this accomplished chemist, in verification of the general fact.

A solution of bichloride of mercury, which is so delicate a test of the presence of albumen, produces no precipitate in artificial mucus. In this respect, it corresponds with natural mucus. The same remark holds true of infusion of gall-nut. The tritacetate of lead, on the contrary, which Dr. Bostock laid down (see *Nicholson's Journal*, Vol. XI. p. 252) as the proper precipitant of mucus, produces a similar precipitate in solutions of the artificial combination. When evaporated to dryness, there is the same transparency, and general resemblance to gum; and the same insolubility, or rather difficult solubility, in water. The only difference which I have remarked—and it is one of degree rather than of kind—is, that the artificial mucus is more easily precipitated by acids; which seems to shew a less intimate union than that which is effected by the chemistry of nature.

The combinations of which I have treated thus far, are those of the caustic alkalies, with pus and other albuminous fluids: but there is another set of combinations with pus, of equal interest, which seem still less to have attracted the attention of animal chemists. I refer to those which are affected by the agency of the neutral salts. Pus is stated, by John Hunter, to be coagulable by sal ammoniac, which no other animal secretion is; and this I believe is the sum of what has hitherto been observed*. The elementary

* I did not meet with Dr. Pearson's observations and experiments on Pus, contained in the *Philosophical Transactions* for 1810, until the revise of this Paper was put into my hands for final correction. Had I done so earlier, I should have curtailed, or perhaps suppressed it. Yet my facts are

chemical works do not even notice this fact. On making the experiment, I have found that it is not coagulation such as heat, alcohol, and acids effect with albumen, which is induced by the addition of this salt, but a combination bearing considerable analogy to that which I have described as taking place with the alkalies. The hydrochlorate of ammonia is entitled to no particular distinction, as possessing this power. Hydrochlorate of soda, nitrate of potassa, sulphate of magnesia, sulphate of soda, sulphate of potassa, all form viscid combinations with pus; and I have found in the case of the three former salts, that, after a lapse of three weeks, those combinations had not undergone any change; being still insoluble in water, and still so tenacious as to be capable, on being poured from a test-tube, of forming a continuous string several feet long. The combination with all the salts that I have named, seems, in its physical characters, to be much the same. I have only examined with minuteness, however, that which is formed with hydrochlorate of soda,

A saturated solution of hydrochlorate of soda added to healthy pus, in the proportion of one-third, and agitated with it so as to bring the particles of each liquid into intimate union, effects a complete change in its properties; and this seems, to a certain extent, progressive. Examined after an interval of a few hours, it is found to have lost its creamy appearance, to have become more diaphanous and homogeneous in texture, and to be so viscid and semi-solid, that if a test-tube of half an inch in diameter has been employed, and three-fourths filled, it may be inverted, and the contents will not gravitate towards the mouth of the tube. The combination is insoluble in water, and immiscible with it, unless by very violent and continued agitation; by which means it becomes diffused like mucus in flocculent portions, and it will remain in that fluid separate and viscid for many weeks. Solution of bichloride of mercury will not precipi-

are not altogether the same as his; and my conclusions, founded on a similarity of chemical re-agencies, establish, I trust, a sufficient degree of originality to entitle the Paper to perusal: and if it should have the effect of attracting more attention to a subject which is certainly not exhausted, it will have its use.

tate it from its mixture with water, but the tritacetate of lead in solution will readily do so. Infusion of galls will corrugate, but not precipitate it: and making a comparative experiment with pure pus, the difference is very striking. If a portion be placed in water, no apparent change takes place by raising it to a boiling heat: it is not hardened, but remains the same viscid mass as before. Alcohol, and the dilute mineral acids, condense it into a solid mass, which preserves a considerable share of tenacity; whereas when these agents are added to pure pus, it is precipitated in minute incoherent particles. If the compound of the alkalies and pus may be likened to pure mucous expectoration, that of hydrochlorate of soda and pus may with equal propriety be likened to expectoration of a muco-purulent character; and the resemblance is, to me, so apparent, that, if dropped into water in separate portions, I am persuaded that I could not distinguish those portions from the sputa of a phthysical patient. The saturated solution of hydrochlorate of soda does not produce any change analogous to that caused by the alkalies upon the serum of blood, or even upon the liquid portion of pus.

From what has been said, it may, I think, appear probable to others, as it does to me, that natural mucus is formed by some combination analogous to that which results from the action of a pure alkali, or of a neutral salt, on pus or albumen, either by actual chemical combination, or by catalytic force: in which latter case, the proportion of the alkali or salt may be of the less consequence.

The intimacy of the union, in the artificial combination, we have seen to be so great, that it is not destroyed by an acid, provided this be largely diluted, even though it be added in quantity quite sufficient to saturate the alkali, were it in an uncombined state. This holds true of natural mucus, when secreted in the bladder: for it is, I believe, to Sir Benjamin Brodie that we owe the remark, that the ropy mucus secreted under a morbid condition of that viscus is alkaline, whilst the urine secreted at the same time occasionally remains acid.

The utility of this power of resisting decomposition is manifest in a fluid which is destined to defend surfaces from the contact of injurious agents. For the purpose of lubrica-

tion, too, it is difficult to conceive any combination more smooth and slippery than are those containing a free alkali. Liniments and soaps are the compounds to which we have recourse, when we wish to obtain these qualities in the highest degree.

In the albuminous urine of renal dropsy I have endeavoured in vain to obtain, by the addition of alkalies, any approach to ropy mucus; but whether this is owing to some counteracting tendency in the other constituents of the urine, or to some alteration in the albumen itself, or whether the proportion is too small to render its viscosity palpable, I have not ascertained. To obviate the last cause of failure, I have concentrated such urine, by evaporation, at a temperature too low to produce coagulation; yet still I had no better success.

L I S T
OF
GENTLEMEN EDUCATED AT GUY'S HOSPITAL,
WHO HAVE BEEN ADMITTED
MEMBERS OF THE COLLEGE OF SURGEONS,
AND THE APOTHECARIES' HALL,
SINCE SEPTEMBER 1836.

College of Surgeons :

NOV. 1836.

Mr. James Godfrey.
 — Thomas Young.
 — William Cooke.
 — Benj. Collinette.

Mr. William Jones.
 — Caleb Basan.
 — Joseph Williams.

DECEMBER.

Mr. John Springall.
 — J. B. Larkins.

Mr. Charles Trenerry.

JANUARY 1837.

Mr. W. H. Barker.
 — Robert H. M'Keand.
 — Benj. Carrington.

Mr. Augustus Slight.
 — Peter Hudson.
 — William Gale.

FEBRUARY.

Mr. Sackville Lupton.
 — Edward Smiles.

Mr. Morgan Williams.
 — Frederick Palmer.

MARCH.

Mr. James Daly.

Mr. Emanuel Dommett.

APRIL.

Mr. William Roberts Jones.
 — Mark Overton.
 — Edward E. Hysh.

Mr. John A. Patterson.
 — Henry Churton.
 — William Griffiths.

MAY.

Mr. Frederick Warner.
 — William Ellis.
 — Pern Blundell.
 — J. J. Clarkson.
 — Nathaniel Whitchurch.
 — A. Corbin.
 — W. Twining.

Mr. Rudd Lucas.
 — J. J. Jackson.
 — J. T. Wollaston.
 — R. D. Mason.
 — George Turner.
 — Charles Hallett.
 — Martin Mauger.

VOL. II.

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| | |
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| Mr. John Breach. | Mr. George Brunton. |
| — R. G. Wollaston. | — Thomas Small. |
| — Edward Barrow. | — Alfred Harmer. |
| — T. Land. | — J. J. Dolman. |
| — E. H. S. Banks. | — Richard K. Morton. |
| — E. Young. | — J. P. Atkinson. |
| — W. W. Williams. | — William Weddell. |
| — Henry Oldham. | — T. Ayling. |

JULY.

| | |
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| Mr. John Jolliffe. | Mr. Edward Briant. |
| — Anthony Crisp. | — F. F. Thompson. |
| — George Cooper. | |

AUGUST.

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| Mr. W. Hamilton Hobkirk. | Mr. William Brailsford. |
| — G. F. Bloxsome. | — J. B. St. Croix Crosse. |
| — J. Denne. | — J. M. Minter. |
| — Henry May. | — W. Benj. Hemmings. |

Apothecaries' Hall :

SEPT. 29, 1836.

| | |
|------------------------|--------------------|
| Mr. John Dickinson. | Mr. Joseph Parkin. |
| — Henry Richard Smith. | — Allen Taylor. |
| — George Eveleigh. | — James Cowherd. |
| — Frederick Heald. | — William Field. |

OCTOBER.

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| Mr. Richard Grimbley. | Mr. John Dymock Scale. |
| — George Kidgell. | — Edward Foot. |
| — John Potter Sergeant. | — William W. Williams. |
| — Sackville Lupton. | — John H. Patterson. |
| — John M. C. Faircloth. | — Joshua Paynter. |
| — John Cartwright. | — Samuel Osborn. |
| — George Frederick Meadows. | — Henry Weeks. |
| — Joseph John Lay. | — James Drew. |
| — Samuel Day Fereday. | — Samuel Farrow. |
| — Augustus Slight. | — Ebenezer Vorley. |

NOVEMBER.

| | |
|-----------------------|----------------------|
| Mr. William Elliston. | Mr. Nicholas Rundle. |
| — John Morley. | — Thomas Davies. |

DECEMBER.

| | |
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| Mr. Joseph Welsby. | Mr. James Plummer. |
| — William Henry Cullen. | — Thos. Edm. Horseman. |
| — Michael Harris. | — Richard Phillips. |

JANUARY, 1837.

| | |
|----------------------------|--------------------------|
| Mr. Nathaniel Whitchurch. | Mr. Parmenas Langley. |
| — C. L. Crosswell. | — Emanuel Dommett. |
| — John Moolenburgh Minter. | — William Barney Parkes. |

FEBRUARY.

| | |
|-------------------------|-----------------------|
| Mr. Thomas Johnson. | Mr. Edwin Chabot. |
| — James Edward Newall. | — George K. Prince. |
| — Richard Gardiner Jay. | — Thomas Neats Moody. |
| — George Jones. | |

MARCH.

| | |
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| Mr. Joseph Manlove. | Mr. Benj. Nelson Lingwood. |
| — Alfred Harmer. | — Isaac Palmer Hall. |
| — Henry Brook. | — George Cooper. |
| — Richard W. Tamplin. | — Edmund Yalden Knowles. |
| — William Shanke Wigg. | |

APRIL.

| | |
|---------------------|-----------------------|
| Mr. F. F. Thompson. | Mr. Frederick Palmer. |
| — John Barker. | |

MAY.

| | |
|-----------------------|---------------------------|
| Mr. William Manthorp. | Mr. Richard Valpy Shuter. |
| — William Cooke. | — Robert Abraham Varicas. |
| — John Smith. | |

JUNE.

| | |
|--------------------|--------------------------|
| Mr. John Allanson. | Mr. Charles Parker Mann. |
| — Henry Churton. | — James Joseph Dolman. |
| — Joseph Morrish. | — James Harmer. |
| — Mark Overton. | |

JULY.

| | |
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| Mr. Henry Bidwell. | Mr. Thomas Napper. |
| — Henry Ashton Meeson. | — Frederick Warner. |
| — John James Mallett. | |

AUGUST.

| | |
|----------------------|------------------------|
| Mr. Charles Housley. | Mr. Robert Vaux Leese. |
| — Joseph Lowdell. | — John Edge. |
| — Charles Rendall. | — Thomas Small. |

SEPTEMBER.

| | |
|-------------------|-------------------|
| Mr. J. B. Easton. | Mr. Henry Oldham. |
|-------------------|-------------------|

MEDICAL SCHOOL OF GUY'S HOSPITAL.

THE Distribution of Prizes and Certificates of Distinction, and of Honorary Diplomas of the Physical Society, took place in the Council Room of the Hospital, on Wednesday the 10th of May, in the presence of the Governors and Lecturers of the Institution, and a crowded assemblage of Pupils and their Friends.—

Sir ASTLEY COOPER, Bart. in the Chair.

The Honours were awarded as follows:—

PHYSICAL SOCIETY.

| | |
|------------------------------------|---------------------|
| Professor Valentine Mott | } Honorary Diploma. |
| Professor Manni | |
| Mr. T. W. King | } Diploma. |
| Mr. John Blackburn | |

PUPIL'S PHYSICAL SOCIETY.

| | |
|-------------------------------------|---------------|
| Mr. John Caddell Brereton | First Prize. |
| Mr. Norman Chevers | Second Prize. |

PRACTICE OF MEDICINE.

| | |
|-----------------------------------|-------------------|
| Mr. John Coates | Gold Medal. |
| Mr. Thomas Remington | Silver Medal. |
| Messrs. { Lancelot Hare | } received Books. |
| Frederick Rose | |
| Charles Nind | |
| John Brett | |

CHEMISTRY.

| | |
|-------------------------------|-----------------------------|
| Mr. W. P. Markham | Prize. |
| Mr. Thomas Longmore | Certificate of Distinction. |
| Mr. G. Whitley | Certificate of Distinction. |

ANATOMY.

| | | |
|--------------------------|-------------------------------------|-----------------------------|
| <i>Second Year</i> . . . | Mr. John Caddell Brereton | Gold Medal. |
| | Mr. William Williams | Silver Medal. |
| <i>First Year</i> . . . | Mr. Thomas Strover | Silver Medal. |
| | Mr. Edward Ringsford | Certificate of Distinction. |

SURGERY.

| | |
|-------------------------------|-----------------------------|
| Mr. Charles Chapman | Prize. |
| Mr. Norman Chevers | Certificate of Distinction. |

OPHTHALMIC SURGERY.

| | | |
|-------------------------|--------------------------------|---------------|
| <i>Third Year</i> . . . | Mr. James Scott | Gold Medal. |
| <i>Second Year</i> . . | Mr. Richard L. Couch | Silver Medal. |
| <i>First Year</i> . . . | Mr. Edward Menzies | Silver Medal. |

MIDWIFERY.

| | | |
|-------------------------|-------------------------------------|-----------------------------|
| <i>Second Year</i> . . | Mr. Charles Taylor | Prize. |
| | Mr. Edward Knowles | Certificate of Distinction. |
| <i>First Year</i> . . . | Mr. Charles H. E. Skinner | Prize. |
| | Mr. Joseph R. Bedford | Certificate of Distinction. |

BOTANY.

| | |
|-------------------------------|-----------------------------|
| Mr. F. J. Bird | Prize. |
| Mr. Thomas Longmore | Certificate of Distinction. |

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ILLUSTRATIONS OF THE MUSEUM.

UNDER this title, it is intended to give an account of such preparations, or series of preparations, as serve to elucidate various important or interesting physiological or pathological facts. It will, undoubtedly, contribute to render these illustrations and descriptions more clear and intelligible, for the reader to be acquainted with the preparations in the collection, and with the principles on which they are so arranged as mutually to elucidate each other.

For this purpose, considerable assistance may be derived from the printed catalogue of the Museum; which is not a mere list of preparations, but, to a certain extent, may be regarded as a synopsis of Pathological Anatomy; in which, although individual descriptions will lose much of their interest, when the preparation is not before the reader, yet, unitedly, they serve to exhibit the connections, dependencies, and other relations, existing between different pathological appearances, as well as the analogies and peculiarities in the derangement of different systems and organs.

The Tables and Observations which accompany the Catalogue not only serve to render the Catalogue itself more intelligible, but they will make it more easy for the distant reader to comprehend the illustrations of Pathological Anatomy founded on the preparations in the Museum.

Since the publication of the Catalogue in the year 1829, the number of preparations has so considerably increased, as to render a pretty extensive Supplement essentially necessary, not merely to the Student and the Visitor, but to those who may feel an interest in the illustrations to be given in the succeeding numbers of the Hospital Reports. For this purpose, it has been thought expedient to devote a few leaves, in each number, to the publication of the Supplement of the Catalogue. The section of Models and Casts has been chosen for the commencement; because, in some preparations of this description, the Museum is not only rich, but nearly, or quite, unique. Those preparations which relate to diseases of the skin, possess peculiar claim to attention, not merely from the circumstance of their representing real cases with a fidelity and minuteness not to be obtained in drawings and plates, but in consequence of the cases having been named, and in many instances selected, by Dr. Addison; who, in addition to a long acquaintance with this subject, enjoyed the advantage of the orally-conveyed and practical information furnished by Drs. Willan and Bateman, whose nomenclature these models may be regarded as authentically elucidating and illustrating. In this way, they have already served to remove misapprehension from the minds of some, who, though they had made skin diseases their particular study, and had adopted the system of Willan, had only become acquainted with it through the medium of published descriptions.

WAX MODELS AND CASTS.*

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|--|---------------------------------------|
| 2608 | Cast of the entire Back, distorted by the Lateral Curvature of the Spine. | | |
| 2609 | Cast of the Shoulders and Back, as low as the Loins; shewing a very considerable curvature to the right side, and a great diminution of that side of the Chest. From softening of the Bones. | | |
| 2609 ^A | Cast of the Back and Shoulders; shewing considerable curvature to the right side, with great protrusion of the right shoulder. | | |
| 2610 | Cast of the Back, with Lumbar Abscess; forming a Tumor in the Loins, to the left of the Spine. | | |
| 2610 ^A | Cast of the Back, with a protrusion on the left side of the Spine; from an Abscess, connected with disease of the Vertebrae. | | |
| 2610 ^B | Cast of the lower part of the Back and Nates; shewing a considerable swelling on the left side of the Spine, from Lumbar Abscess. | | |
| 2610 ^C | Cast of the lower part of the Back, and part of the Nates, with considerable Tumors over the Sacrum; from Fungoid Disease. (See Prepns. 1292 1st A, 1292 2d A. and a Drawing, No. 10.) | 8th Green Inspec. Book, page 119. Case of W. Page, aged 18. | |
| 2611 | Cast of the lower part of the Abdomen, and part of the Thighs; shewing a Lumbar Abscess, which produced a large pointing Tumor about the anterior Spinous Processes of the left Ilium. From a Boy, a patient of C.A. Key, Esq. | | |
| 2612 | Cast of the lower part of the Abdomen and upper part of the Thighs; shewing a Lumbar Abscess, forming a large Tumor under Poupart's Ligament on the right side. | | |
| 2613 | Cast of the left side of the Thorax; shewing a deficiency of the greater part of the third Rib. (See Prepns. 1044, 1771, and 2456.) | 4th Green Inspec. Book, page 120. Case of John Welsh | |
| 2614 | Cast of the Head and Face of James Cardinal, aged 27, who was affected, from his infancy, with Hydrocephalus. Taken before death. | | |
| 2615 | Cast of the Head and Face of the preceding subject, taken after death; the hair having been removed. (See Skeleton, No. 889.) | 1st Note Book, page 72. Case of Jas. Cardinal, aged 29. | |
| 2615 ^A | Cast of the head of H.M., aged 14½ years, affected from birth with Chronic Hydrocephalus, in whom the signs of puberty had made their appearance at 9 years of age. (See Cast, 2620 1st.) | 1st Note Book, page 219 | Arch. Dalrymple, Esq. Norwich. |
| 2616 | Bust of Nicholson, the young man who murdered Thompson Bonnar, Esq. and his Wife. From a Cast taken after execution by G. Lewis, Esq. | | Sir Astley Cooper. |

* In consequence of the large number of additions, it has been thought best to reprint this Section.

Wax Models and Casts

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|---|---------------------------------------|
| 2617 | Cast of the Head and Face of Williams, who was supposed to be the murderer of the families of Marr and Williams. | | |
| 2618 | Cast of the Head and Face of John Birt, who was executed at Horsham for the murder of his child. (See Skeleton, No 891.) | | |
| 2618 ^A | Bust of Richard Lamborne, a murderer and suicide. (See Prepn. 1710 ^A .) | 1st Miscellan. Inspec. Book, page 66. | |
| 2618 ^B | Bust of Esther Hibner, executed at the Old Bailey, 13th of April, 1829, for starving her Apprentice. (See Prepn. 419 ^B . Skeleton, 891 ^D .) | | |
| 2618 ^C | Bust of — Taylor, executed at Aylesbury for murder. | | |
| 2618 ^D | Bust of — Stoffell, executed at Horsemonger Lane Jail, for the murder of Mrs. Richards of Clapham. | | |
| 2618 ^E | Bust of — Keppell, executed at Horsemonger Lane Jail, for the murder of Mrs. Richards of Clapham. | | |
| 2618 ^F | Mask of — Nesbitt, executed at Maidstone in 1820, for the murder of an old man and his housekeeper. | | |
| 2619 | Cast of the Head and Face of James Hatfield, who shot at King George the Third. Taken at the New Bethlehem Hospital, by Dr. Wright. | | Dr. Wright. |
| 2619 ^A | Cast of the Head and Face of Hoo Loo, a Chinese Sailor, who died at Guy's Hospital, after an operation for the removal of a Tumor from the Pelvis, weighing 56 pounds. (See Preps. 419 ^A . 967 ^{1st} . 1620 ^E . 1620 ^F . Cast, 2798 ^B , and Drawings.) | | |
| 2619 ^B | Cast of the Face of a Man having a Tumor connected with the Jaw-bone. He came into the hospital for the purpose of undergoing an operation; but went out, unwilling to have it performed. | | |
| 2619 ^C | Cast of the right side of the Neck and Shoulder; shewing a swelling in the neck, occasioned by a cyst filled with sanguinolent and puriform serum: it appeared to be situated between the muscles. | Case of Bowyer. | |
| 2619 ^D | Cast of the top of the Head; shewing a remarkable depression in the left parietal bone, occasioned by a fall. | | |
| 2620 ¹ | Cast of the Head of H. M., aged 14½, affected with Chronic Hydrocephalus. (See Bust, 2615 ^A .) | 1st Note Book, page 212. | A. Dalrymple, Esq. |
| 2620 ² | Cast of a Hand, with a supernumerary little-finger. | | |
| 2620 | Cast of the Shoulder, Arm, and Hand, of Ann Coulson, affected with a large Osteo-sarcomatous Tumor. Amputated, at the shoulder-joint, by Sir Astley Cooper. | Cat. xciv 1. and Sir Astley Cooper's Surgical Essays. | Brookes's Collection. |
| 2620 ^A | Cast of the Elbow and fore Arm, after fracture of the Olecranon. From a patient of C. A. Key, Esq. | | |
| 2620 ^B | Cast of the Elbow and fore Arm, shewing dislocation. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|--|---------------------------------------|
| 2620 ^C | Wax Model of the fore Arm and Hand, in which Gangrene had taken place. The patient was a Washerwoman, aged 55. (See Prep ⁿ .) | 7th Miscellan. Inspec. Book, page 94. Case of Sarah Warner. | |
| 2620 ^D | Wax Model of the fore Arm and Hand, from the same Case as the preceding; but of a later period, when the process of spontaneous separation had commenced. (See Prep ⁿ .) | Ditto. | |
| 2621 | Cast of the fore Arm and Hand, shewing fracture near the lower extremity of the Radius, and displacement of the Ulna. | | |
| 2621 ^A | Cast of the fore Arm and Hand, with false joint, from un-united fracture of the Radius and Ulna. From a patient of J. Morgan, Esq. (See Prep ⁿ . 1119 ^u .) | | |
| 2621 ^B | Case of the same Arm, straightened. (See Prep ⁿ . 1119 ^u .) | | |
| 2621 ^C | Cast of the Wrist and Hand, with dislocation forwards. | | |
| 2622 | Cast of a fore Arm, with part of the Hand, which has lost all its Fingers, and portions of several of the Metacarpal Bones. | Cat. xciii. 1. | Brookes's Collection. |
| 2623 | Cast of a right Hand, from which the middle Finger had been amputated. | | |
| 2623 ^A | Cast of a right Hand, from which the middle Finger and its Metacarpal Bone had been removed. | | |
| 2624 ^I | Cast of a Hand, distorted by Chronic Rheumatism. | | |
| 2624 | Cast of a right Hand; shewing a dislocation of the Metacarpal Bone of the Thumb. | | |
| 2624 ^A | Cast of a Hand; showing dislocation of the first Phalangeal Bone of the Thumb. (See a Drawing.) | | |
| 2625 | Cast of a Hand, contracted by Chronic Spasm: taken from a young man. The affection was brought on by a blow from a hammer, received on the thumb-nail. After having, for some months, resisted all the remedies which were tried, it was immediately relieved by the Electric Aura, and was ultimately cured by it. | Cat. ccxxiv. 2. | Brookes's Collection. |
| 2626 | Wax Model of a right Hand; shewing an extensive Ulceration, from Scrofulous disease, of the Metacarpal Bone of the Thumb. | | |
| 2627 | Wax Model of a Fungoid Tumor near the Elbow, and a Cicatrix produced by an operation for the removal of a similar tumor. The arm was amputated by B. B. Cooper, Esq. (See Prep ⁿ . and a Drawing by Mr. Peacock.) | | |
| 2627 ^A | Cast of the Arm of a Man, affected with Fungus Hæmatodes. The tumor was of twenty years' standing. The arm was amputated on the 23d of April, 1830, by J. H. Green, Esq., at St. Thomas's Hospital. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|-----------------------|---------------------------------------|
| 2628 | Cast of part of the fore Arm, with the Hand; shewing two large Fungoid Tumors on the inner side. John Hunter amputated the little Finger; and, ten years after, the ring Finger was amputated by Mr. Chevalier, who attended the case in consultation with Mr. Brooks. | Cat. cccxxxv. 2. | Brookes's Collection. |
| 2628 ^A | Cast of the fore Arm and Hand; with a malignant Tumor, growing from the Metacarpal Bone of the little Finger. From a Patient of C. A. Key, Esq. (See Prep ⁿ . 1124 ^z . and Drawing.) | | |
| 2629 | Cast of part of the fore Arm and Hand; with a large Fungoid Tumor, in a state of Ulceration, occupying the greater part of the Dorsum of the Hand. Sir Astley Cooper removed the diseased parts, when of moderate extent; but the disease returned, affecting the Metacarpal Bones. (See Prep ⁿ . 1636.) | | |
| 2630 | "A Torso, moulded under Mr. Brookes's superintendence, from the living subject, afflicted with an immense Osteo-sarcomatous Tumor situated on the right Hip. An operation was performed for the relief of the patient, by Sir Astley Cooper." | Cat. ccclvi. 2. | Brookes's Collection. |
| 2631 | Cast of the lower quarter of the Trunk, with the corresponding Thigh; shewing a very large Osteo-sarcomatous Tumor growing from the Os Femoris. Made by Mr. De Lestre. | | |
| 2632 | Cast of a Thigh, Leg, and Foot; shewing a very large Osteo-sarcomatous Tumor growing from the former. | | Mr. Blundell's Museum. |
| 2633 | Cast of the lower part of the Body, with the lower extremities. On the right Thigh there is a very large Osteo-sarcomatous Tumor: the corresponding Leg very much swollen by Edema. | Cat. ccclix. 2. | Brookes's Collection. |
| 2634 | Cast of the Knee, with part of the Thigh and Leg; shewing a large Osteo-sarcomatous Tumor on the lower part of the Femur. | | |
| 2635 | Cast of the upper part of the Thigh Bone, which appears to have been fractured through the neck, partly within and partly without the Capsular Ligament, and to have been subsequently united. | | |
| 2635 ^A | Cast of the head and neck of the upper part of a Thigh Bone in the possession of Dr. Mussey, of New Hanover, United States; and supposed to be an instance of united fracture within the Capsular Ligament. (See Drawings by Canton.) | | |
| 2636 | Cast of an adult Thigh Bone, fractured, apparently with comminution, a little below the Trochanters, and very badly united. | Cat. lxxix. 1. | Brookes's Collection. |
| 2637 | Cast of a Thigh Bone, fractured a little above the middle, and very badly united. | Cat. lxxx. 1. | Ditto. |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|-----------------------|---------------------------------------|
| 2638 | Cast of the Knee, after fracture of the Patella: the two portions of bone widely separated. | | |
| 2639 | Cast of the upper part of the Tibia and Fibula, with a large Fungoid Exostosis about the head of the former. | Cat. cvi. 1. | Brooker's Collection. |
| 2639 ^A | Wax Model of a portion of the Tibia, about four inches in length, thrown off after fracture. The limb was preserved, and was serviceable. (See Drawing.) | | |
| 2639 ^B | Cast of the lower part of the Leg and Foot of Mary Cannon, an individual of imperfect sex and intermediate form. (See Prep ⁿ . 2545A, 2431A, and Cast 2819A.) | Case of Mary Cannon. | |
| 2640 | Cast of the lower part of the Leg and Foot of a Child, in whom fracture of the Tibia and Fibula was followed by the formation of a false joint. | | |
| 2641 | Cast of the lower part of the Leg and Foot of a young subject, very much deformed: the Ankle bent strongly inwards. | | |
| 2642 | Cast of a Club Foot, with considerable Distortion inwards, from a Child ten years of age: it was cured in fourteen months. (See Prep ⁿ . 2643.) | | |
| 2642 ^A | Plaster Cast of a Distorted Foot. The Astragalus thrown outwards, and the foot curved in the same direction. | | |
| 2643 | Another Cast from the same case as N ^o . 2642. | | |
| 2644 | Cast, from a specimen of Club Foot. | | |
| 2644 ^A | Wax Model of the lower part of the Leg and Foot, of small size, and much distorted from the influence of pressure, copied from a Chinese Female's Foot, then preserved in spirits, but since dissected and dried. (See Prep ⁿ . 899A. and a Paper by B. B. Cooper, Esq., in the Philosophical Transactions.) | | |
| 2645 | Cast of the lower part of the Leg and Foot, with distortion of the Ankle, and fracture of the Internal Malleolus. | | |
| 2646 | Cast of a Foot, in which all the Metatarsal and Phalangeal Bones, except those of the great Toe, had been amputated by C. A. Key, Esq. | | |
| 2647 | Cast of a Dislocation of the Patella; from a Child. | | |
| 2648 | Another Specimen, from a Child, a patient of C. A. Key, Esq. | | |
| 2649 | Cast of a Dislocation of the Patella, outwards; from an Adult. | | |
| 2650 | Cast of a Dislocation of the Tibia, backwards; from disease:—distortion very considerable. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History | By whom presented, or whence derived. |
|-------------------|--|--|---------------------------------------|
| 2650 ^A | Cast of a Dislocation of the Tibia, backwards and outwards. | | |
| 2650 ^B | Cast of the lower part of a Thigh, Leg, and Foot, amputated by B. B. Cooper, Esq. for Dislocation of the Tibia outwards. (See Prep ^a . 1345 ^A .) | | |
| 2651 | Another Cast of Dislocated Patella; from an amputated Leg. | | |
| 2652 | Cast of the Leg and Foot of a Child; shewing Distortion, from Scrofulous Disease of the Ankle. | | |
| 2653 | Cast, shewing slight Displacement of the Ankle, supposed to depend on Dislocation of the Astragalus outwards and forwards, with fracture of the Tibia. | | |
| 2654 | Cast, shewing Dislocation of the Ankle outwards. From a Female. | | |
| 2655 | Cast, shewing Dislocation of the Ankle outwards. From a Male. | | |
| 2656 | Cast of a Leg and Foot; shewing Dislocation of the Ankle forwards. | | |
| 2657 | Cast of a Fungoid Tumor on the Hip. | | |
| 2658 | Cast of a Fungoid Tumor on the anterior part of the Thigh. | Sir Astley Cooper's Surgical Essays. Case of — Gordon. | |
| 2659 | Cast from the same subject; the disease much further advanced, and forming a large Ulcer with elevated edges. | | |
| 2659 ^A | Plaster Cast of the Knee and upper part of the Leg, with a Tumor, probably Fungoid, near the head of the Fibula. From a patient of B. B. Cooper, Esq. in Lydia's Ward. | | |
| 2660 | Cast of an amputated Leg and Foot; shewing a Fungoid Tumor, with a large ulcerated surface on the upper and outer part of the Leg. | | |
| 2661 | Cast of part of a Leg and Foot, with an ulcerated Fungoid Tumor on the former. | Cat. cxxiv. 1. | Brookes's Collection. |
| 2662 | Cast of the lower part of the Leg and Foot, with a Fungoid Tumor near the outer Malleolus. The Leg was amputated by B. B. Cooper, Esq. | | |
| 2663 | Cast of the upper part of a Leg and Foot, the latter much enlarged, and distorted by a Fungoid Tumor. | | |
| 2664 | Cast of a Knee; shewing Ganglion of the Patella. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, & whence deriv ^d . |
|-------------------|---|--------------------------|--|
| 2664 ^A | Cast of a Foot, affected with Bunion. See Prep ^a . 1377 ^B . | | |
| | (2.) <i>Models and Casts supplementary to Sect. III.</i> | | |
| 2665 ¹ | Cast of the anterior part of the Chest; showing a Tumor formed by Aneurism of the Aorta, the Innominata, or right Subclavian. Taken before death, which occurred from the Aneurism bursting into the Thorax. | 1st Note Book, page 141. | R. Blanchu Esq. Poplar. |
| 2665 | Cast of the Back; shewing an Aneurismal Tumor. | | |
| 2666 | Cast of the lower part of a Leg and Foot; shewing Aneurism of the posterior Tibial Artery. The operation was performed by C. A. Key, Esq. | | |
| 2667 | Cast of the middle of an Arm; showing an Aneurismal Varix. | | |
| 2668 | Another similar specimen. | | |
| 2668 ^A | Cast of a Hand, with small Aneurismal Varix at the back of the fore Finger, near the extremity of the Metacarpal Bone. | | |
| 2669 | Cast of part of the right Thigh and Leg; shewing large Varicose Veins. From a Boy, a patient in Naaman's Ward. | | |
| 2670 | Cast of the left Leg and Foot, from the same subject; the Veins similarly affected. There was a small Ulcer near the outer Malleolus. | | |
| 2671 | Cast of part of a Thigh and Leg; shewing greatly enlarged and Varicose Veins. From a patient in one of the Hospitals at Paris. | | W. T. Iliff, Esq. |
| 2672 | Cast of the Head and Neck of a Child; shewing one of the Absorbent Glands immediately below the Ear greatly enlarged by Scrofula. | | |
| 2673 | Cast of part of a Head, Neck, and Chest; shewing a large Tumor on the left Cheek and side of the Neck, produced by Scrofulous Enlargement of the Glandulæ Consecutivæ. From a Boy, a patient of J. Morgan, Esq. | | |
| 2674 | Cast of a Face, Neck, and part of the Head; with a very large ulcerated Fungoid Tumor occupying the left side of the Head, and part of the Neck. | | |
| 2675 | Cast of part of the Head, Face and Neck of Joseph Rogers, aged 27, affected with a large Absorbent Glandular Tumor on the right side of the Neck: it was of seven years' standing, and was unaccompanied with pain. Made by Mr. De Ville. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|--|---------------------------------------|
| 2676 | A similar Cast, taken from the same individual about ten days after the Tumor, which weighed three pounds and a quarter, had been removed by Sir Astley Cooper. The man has since remained quite well. (See Prep ⁿ . 1540.) | See a Note, given by Mr. Edenborough. | |
| 2677 | Cast of the Face, Neck, and Chest of a middle-aged Woman affected with a very large Tumor, in structure resembling Fungus, but more dense, situated on the right side of the Face and Neck, which appeared to have originated in an Absorbent Gland. It was removed by J. Morgan, Esq. (See Prep ^{ms} . No. 1541 ^c , 1541 ^d , 1541 ^e , and a Drawing.) | 6th Green Inspec Book, page 108. Case of Mary Jones | |
| 2678 | Cast of the Face and Neck of an old subject, with a large Fungoid or Carcinomatous Tumor under the Chin. The disease appeared to have originated in an Absorbent Gland. | | |
| 2679 | Wax Model of part of a Face; shewing a large deep Carcinomatous Tumor on the side of the left Cheek. | | |
| 2680 | Wax Model of a Face and Neck; shewing extensive malignant Ulceration on the right side. | | |
| 2681 | Wax Model of the Axilla; shewing a Fungoid Tumor apparently proceeding from one of the Axillary Glands. | | |
| 2682 | Plaster Cast of Lumbar Glands, greatly enlarged by Fungoid Disease, and displacing the Kidneys. | See the Note relating to the Cast. | W. T. Hill, Esq. |
| 2682 ^A | Cast of the lower part of the Abdomen and upper part of the Thighs, with a large Fungoid Tumor in the left Groin, supposed to be connected with the Inguinal Glands. From a patient of B.B. Cooper, Esq. (See Prep ⁿ . 1559 ^A .) | | |
| | (3.) <i>Models and Casts supplementary to Sect. IV.</i> | | |
| 2683 | Cast of a Fœtus affected with Hernia Cerebri: it is in other respects deformed, wanting both the fore Arms and Hands. The Feet are much distorted. (See Prep ⁿ . 2542.) | | |
| 2684 | Cast of the upper part of a Child, nearly two years old. It had a large Tumor on the Head, from Congenital Hernia Cerebri. (See Prep ^{ms} . 1055 ^A and 1563.) | | |
| 2684 ^A | Wax Model of a Child affected with Hernia Cerebri, caused by a kick from a horse. (See Drawing by C. J. Canton.) | | |
| | •• The Models of the Diseases of the Skin are arranged according to the Classification of Drs. Willan and Bateman. | | |
| 2685 | Wax Model of the Face and Neck of an Infant: the former is spotted with Strophulus, the latter with Rupia. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|---|---------------------------------------|
| 2686 | Wax Model of part of a Thigh and Leg affected with Lichen. | | |
| 2686 ^A | Wax Model of a Thigh affected with Lichen. | | |
| 2687 | Wax Model of part of the Abdomen, thickly covered with Lichen, interspersed with a few small Pustules. (Venereal.) | | |
| 2688 | Wax Model of part of an Arm, sprinkled with Lichen, intermixed with a few small Pustules. (Venereal.) | | |
| 2689 | Wax Model of part of the Abdomen, with clusters of Venereal Lichen on the decline. | | |
| 2690 | Wax Model of part of the Arm, sprinkled with Lichen: the Papulæ large, and some of them desquamating. (Venereal.) | | |
| 2690 ^A | Wax Model of part of an Arm affected with Lichen: the Papulæ large, and some of them of a Vesicular character, approaching to Ecthyma. | | |
| 2691 | Wax Model of part of an Arm, sprinkled with Venereal Lichen, having a good deal of the character of Ecthyma. | | |
| 2692 | Wax Model of part of an Arm affected with Venereal Lichen, in character approaching to Ecthyma. | | |
| 2692 ^A | Wax Model of part of an Arm affected with Venereal Lichen. | | |
| 2692 ^B | Wax Model of a Back affected with Venereal Lichen, intermixed with Vesicles and Pustules. | | |
| 2693 | Wax Model of part of an Arm affected with Venereal Lepra: some of the spots are at their height; others are on the decline. | | |
| 2694 | Wax Model of the Arm of a Man affected with Prurigo. | | |
| 2694 ^A | Wax Model of an Arm affected with Lepra. (Venereal.) | | |
| 2695 | Wax Model of considerable part of the Abdomen, affected with Venereal Lepra. | | |
| 2696 | Wax Model of the Knee, and part of a Leg, exhibiting Lepra Vulgaris. | | |
| 2696 ^A | Wax Model of the Thigh and Leg of a Girl, aged 11½ years, affected with Lepra Vulgaris on a strumous skin, in an inveterate form. | 7th Miscellan. Inspec. Book, page 53 Case of Catherine Davis | |
| 2697 | Wax Model of a Hand and fore Arm of a Girl affected with Lepra: the scales assumed a remarkably elevated and limpet shape. The result of the absence of desquamation. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|--------------------|--|-----------------------|---------------------------------------|
| 2698 | Wax Model of part of the Thigh, Knee, and Leg of the same subject; exhibiting Crusts of the same form, but larger, and discoloured by Sordes. | | |
| 2699 | Wax Model of part of the Arm of a Boy affected with Lepra, somewhat resembling the preceding specimen. | | |
| 2700 | Wax Model of part of the Thigh, Knee, and Leg of the same subject. | | |
| 2700 ^A | Wax Model of an Arm affected with Syphilitic Lepra. | | |
| 2700 ^B | Wax Model of an Arm affected with Venereal Lepra. | | |
| 2700 ^C | Wax Model of part of a Thigh and Leg of a Child, affected with Lepra, passing into Porrigio Favosa. | | |
| 2700 ^{*1} | Wax Model of the Arm of a young Woman affected with Lepra—a peculiar form, the reddened Cutis beneath the scales being elevated. | | |
| 2700 ^D | Wax Model of a Knee and part of a Leg affected with Syphilitic Psoriasis. | | |
| 2700 ^E | Cast of the fore part of a Thigh and Knee affected with Lepra or Psoriasis. | | |
| 2700 ^F | Wax Model of the Hand of a Female which is affected with an aggravated form of Psoriasis Palmaris. | | |
| 2700 ^G | Wax Model of the Hand, affected with Psoriasis, affecting the Palm, and interior of the Fingers: it is sprinkled with dark-coloured spots, resembling the obstructed follicles in acne punctata, but they are probably the result of small vesicles beneath the thickened cuticle. | | |
| 2701 | Wax Model of the Face of a Woman affected with Venereal Psoriasis. | | |
| 2702 | Wax Model of part of the Arm of a Boy affected with Ichthyosis. | | |
| 2702 ^A | Wax Model of the Hand and fore Arm of a Man, affected with Ichthyosis, in whom this state of skin was hereditary, and had been in his family for several generations. He exhibited himself, as the Porcupine Man. (See Prep ⁿ . 2702 ^B .) | | |
| 2702 ^B | Wax Model of the fore part of the Thigh and Knee of the same subject. (See Prep ⁿ . 2702 ^A .) | | |
| 2703 | Wax Model of the Abdomen and Thighs of an Infant, with Measles on the decline. | | |
| 2703 ^A | Wax Model of the Hand and Wrist, affected with Roseola Annulata. | | |
| 2704 | Wax Model of the Knee and part of a Leg affected with Purpura of an unusual character. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|--|---------------------------------------|
| 2705 | Wax Model of the Arm of a young Man, affected with Purpura, consequent to Vaccination. | | |
| 2706 | Wax Model of part of the Back and Nates of a Child, affected with Purpura, in small spots. | | |
| 2706 ^A | Wax Model of the Arm, affected with Purpura, from Scorbutus (Sea Scurvy). | | |
| 2706 ^B | Wax Model of part of the Thigh and Leg, affected with Purpura, from Scorbutus (Sea Scurvy). | | |
| 2706 ^C | Wax Model of the fore part of the Leg, affected with Erythema Nodosum. | | |
| 2706 ^D | Wax Model of the fore part of the Leg, affected with Erythema Nodosum, on the decline; the skin partially assuming a yellowish colour. | | |
| 2706 ^E | Wax Model of part of the Leg and Foot affected with Pemphigus. | | |
| 2707 | Wax Model of the Elbow; shewing several Bullæ, from Pompholyx, on the inner side of the bend of the Arm. | | |
| 2708 | Wax Model of the Hand of a Man, the back of which is affected with Pompholyx: the blebs were filled with bloody serum. | | |
| 2708 ^A | Wax Model of a Thigh and Leg affected with Pompholyx Phlyctenodes. | | |
| 2708 ^B | Wax Model of a Foot affected with Pompholyx: the patient's constitution was broken down by disease and mercury. | | |
| 2709 | Wax Model of the Foot of a young Man, with three large Bullæ (Pompholyx) on the Ankle and Dorsum of the Foot: they supervened, on injury of the Spine, which produced perfect Paraplegia. (See 1036, 2034, and 2096.) | 4th Green Inspec. Hook, page 55. Case of J. Harlow. | |
| 2710 | Wax Model of the Hand of a Female, the back of which is affected with Impetigo Sparsa on the decline. | | |
| 2710 ^A | Wax Model of the Face of a Boy, affected with Impetigo. | | |
| 2711 | Wax Model of the Hand of a Man, the back of which is affected with Impetigo Sparsa of long standing. | | |
| 2712 | Wax Model of the Arm and Hand, extensively affected with Impetigo Sparsa. | | |
| 2713 | Wax Model of a Leg affected with Impetigo Sparsa, approaching to Scabida. | | |
| 2714 | Wax Model of the anterior part of a Leg affected with Impetigo, approaching to the species Scabida. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|---------------------------|---------------------------------------|
| 2714 ^A | Wax Model of a Foot and Leg affected with Impetigo Scabida greatly swollen, with disease of the Subcutaneous Cellular Membrane. | | |
| 2714 ^B | Wax Model of the Foot of a Female, the Dorsum and Toes of which were affected with Impetigo Scabida. | | |
| 2714 ^C | Wax Model of part of the Head of a Girl 13 years of age, affected with Porrigio Lupinosa. The spots are small, and in an incipient state; and there is a hair in the centre of each. | Case of Elizabeth Smedley | |
| 2714 ^D | Wax Model of the Head of a Boy 8 years of age, affected with Porrigio Lupinosa. | Case of Robert Laing. | |
| 2714 ^E | Wax Model of the Back and Upper Arm of a young Woman, affected with Porrigio Lupinosa. | | |
| 2714 ^F | Wax Model of the Nates, and back part of the Thighs of a young Man, affected with Porrigio Lupinosa, in an aggravated form: the crusts are several inches in circumference, and very thick and rugged. From a patient of J. Morgan, Esq. | See Case. | |
| 2715 | Wax Model of the upper part of the Head, severely affected with Porrigio Favosa. | | |
| 2715 ^A | Wax Model of the Head of a Child, affected with Porrigio Favosa. | | |
| 2715 ^B | Wax Model of the Head and Face of a Child, 2 years old, affected with Porrigio Favosa. | Case of Henry Dickenson. | |
| 2716 | Wax Model of the Face of an adult Female, affected with Porrigio Favosa in an acute form. | | |
| 2717 | Wax Model of the Face of an adult Male, affected with Venereal Lichen, passing into Ecthyma. | | |
| 2718 | Wax Model of an Arm thickly covered with Ecthymatous Pustules. (Venereal.) | | |
| 2718 ^A | Wax Model of a Neck and part of the Breast, affected with Ecthyma, with Ulceration and surrounding Inflammation. | | |
| 2719 | Wax Model of the fore Arm, affected with Venereal Ecthyma. | | |
| 2720 | Wax Model of a Shoulder and upper Arm affected with Cachectic Ecthyma; some of the spots approaching to Rupia. | | |
| 2720 ^A | Wax Model of the Shoulder and upper part of the Arm, affected with Venereal Ecthyma, from a Negro. | | |
| 2721 | Wax Model of the fore Arm, affected with Ecthyma Cachecticum, the scab assuming a peculiar honey-comb appearance. | | |
| 2721 ^A | Wax Model of a Thigh affected with Ecthyma, with a tendency to Phlegmon. | | |

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Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|-------------------------|---------------------------------------|
| 2721 ^B | Wax Model of the lower part of the Back and Nates affected with a large circular line of Ulceration, the result of Ecthyma; bearing some resemblance to Impetigo. | | |
| 2722 | Wax Model of the fore Arm, affected with Variola. The early stage is shewn. | | |
| 2722 ^A | Wax Model of an Arm affected with Variola. (3d Day.) | | |
| 2722 ^B | Wax Model of an Arm affected with Variola. (5th Day.) | | |
| 2722 ^C | Wax Model of an Arm affected with Variola. (7th Day.) | | |
| 2722 ^D | Wax Model of an Arm affected with Variola. (9th Day.) | | |
| 2723 | Wax Model of the fore Arm, affected with Variola in an advanced stage. | | |
| 2723 ^A | Wax Model of the fore Arm and Hand, affected with Small-pox after Vaccination; the Pustules are large, distinct, and pale, with some Areola. From Dr. Cholmeley's Servant. | | |
| 2724 | Wax Model of part of the fore Arm; shewing a variety of Scabies Purulenta, combined with Scabies Papuliformis. | | |
| 2724 ^A | Wax Model of the Neck and Breast of a Child, 3 months old, affected with Scabies, accompanied by Porrigo Favosa. | See Case of W Johnston. | |
| 2724 ^B | Wax Model of the Leg and Foot of the same Subject. | See Case. | |
| 2725 | Wax Model of a Hand affected with Scabies Purulenta. | | |
| 2726 | Wax Model of the Hand of an Infant, affected with Scabies Purulenta. | | |
| 2726 ^A | Wax Model of an Arm and Hand affected with Scabies Purulenta. | | |
| 2726 ^B | Wax Model of an Arm and Hand affected with Scabies Purulenta, Venereal Iichen, and Ecthyma. | | |
| 2727 | Wax Model of a part of the Thigh and Leg, affected with Scabies Purulenta. | | |
| 2727 ^A | Wax Model of a Knee and Leg affected with Scabies Purulenta. | | |
| 2727 ^B | Wax Model of a Leg affected with Scabies Purulenta, ulcerating. | | |
| 2727 ^C | Wax Model of a Hand affected with Scabies Purulenta. The matter pale, causing some resemblance to Eczema Solare. | | |
| 2727 ^D | Wax Model of the Arm and Hand of a Cachectic Child, affected with a Vesicular Eruption of long standing, apparently a variety of Scabies. From a patient in Barnabas Ward. | See Case. | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History | By whom presented, or whence derived. |
|-------------------|---|----------------------|---------------------------------------|
| 2727 ^E | Wax Model of the Leg and Foot, similarly affected to the preceding. | | |
| 2727 ^F | Wax Model of the Leg of a Woman, who, in the 7th month of pregnancy, was affected with an obstinate Eruption—Vesicular, and resembling aggravated Scabies; but accompanied by an Eruption of another form, more like Eczema. From a patient of Dr. Addison's, in Miriam's Ward. | | |
| 2727 ^G | Wax Model of the Back of a Child, M. Deacon, affected with Variacella, at the 8th Day. | | |
| 2727 ^H | Wax Model of the Arm of a Child, shewing the Vaccine Pock, on the 3d, 4th, and 5th days. | | |
| 2727 ^I | Wax Model of the Arm of a Child, shewing the Vaccine Pock, on the 6th, 7th, and 8th days. | | |
| 2727 ^J | Wax Model of the Arm of a Child, shewing the Vaccine Pock, on the 9th and 10th days. | | |
| 2727 ^K | Wax Model of part of the Back affected with Herpes Phlyctenodes? or Zoster. | | |
| 2727 ^L | Wax Model of the upper and back part of the Trunk, affected with Herpes or Zoster. | | |
| 2727 ^M | Wax Model of the upper part of the Thigh, affected with Herpes Circinatus. | | |
| 2728 | Wax Model, shewing Cachectic Rupia affecting the Scalp. | | |
| 2729 | Wax Model of the Face of a young Woman affected with Rupia. Made by M. De Lestre. | | |
| 2730 | Wax Model of the outer side of the Knee, with a large Crust, assuming a peculiar honey-comb appearance. From the same subject as the preceding. | | |
| 2731 | Wax Model of the Face of a Man, affected with Rupia. | | |
| 2731 ^A | Wax Model of the Face of a Man, affected with Rupia. | | |
| 2731 ^B | Wax Model of a Face affected with Rupia, with severe constitutional irritation. | | |
| 2731 ^C | Wax Model of an Arm affected with Rupia. | | |
| 2731 ^D | Wax Model of part of an Arm affected with Rupia. | | |
| 2731 ^E | Wax Model of a Leg, with various spots of Syphilitic Rupia, in various stages. | | |
| 2731 ^F | Wax Model of part of a Thigh affected with Rupia, with extensive Ulceration after the falling off the Scab. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, whence deriv. |
|---------------------|---|-----------------------------|----------------------------------|
| 2731 ^o | Wax Model of the Leg and Foot of a Girl affected with a Vesicular Eruption, resembling Rapia, and following common fever. From a Patient of Dr. Cholmeley's, in Lydia's Ward. | See Clinical Book for 1838. | |
| 2731 ^m | Wax Model of part of the Chest, affected with Miliaria. | | |
| 2731 ^l | Wax Model of an Arm affected with Miliaria. | | |
| 2732 | Wax Model of the Hand and Wrist, affected with Eczema, the lymph having become turbid. | | |
| 2732 ^A | Wax Model of a Hand affected with Eczema Solare in an aggravated form. | | |
| 2732 ^B | Wax Model of the Head and Face of a Boy affected with Eczema. | | |
| 2732 ^C | Wax Model of the upper third of a young Man affected with Eczema Rubrum. (See Drawing.) | | |
| 2732 ^D | Wax Model of the Hand of a Man severely affected with Eczema Rubrum, which proved fatal. | See Case of W. Knipe. | |
| 2732 ^E | Wax Model of the right Arm, and Side of the Chest; shewing severe Eczema Rubrum, from the same Patient as the preceding. | See Case of W. Knipe. | |
| 2732 ^F | Wax Model of an Arm affected with Eczema Rubrum. | | |
| 2732 ^G | Wax Model of the lower part of the Abdomen and part of the Thigh of a Lad, affected with Eczema Rubrum. | | |
| 2732 ^H | Wax Model of the Arm and Hand of a Man, affected with Eczema, from taking Arsenic. | | |
| 2733 ^{1st} | Wax Model of a Face, with small red tubercles scattered over the Nose and prominent parts of the Cheeks. | | |
| 2733 | Wax Model of the Face of a Woman, affected with the smooth Venereal Tubercle. | | |
| 2733 ^A | Wax Model of a Face affected with the smooth Venereal Tubercle. | | |
| 2733 ^B | Wax Model of the Face of a Boy, affected with Venereal Tubercles, and Blotch, with Ulceration, on a Strumous Skin. | | |
| 2733 ^C | Wax Model of the Face of a Man, with Venereal Tubercles of large size. (See a Drawing, No. .) | | |
| 2733 ^D | Wax Model of a Hand and Arm, affected with Venereal Tubercle. | | |
| 2733 ^E | Wax Model of the Hand and Arm, affected with Venereal Tubercles, becoming Warty, and common Verrucae. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|---|---------------------------------------|
| 2733 ^F | Wax Model of part of the Face of a Child, affected with Molluscum. | See Case by G. Bird. | |
| 2733 ^G | Wax Model of part of the Back and Shoulders, affected with Acne Punctata. | | |
| 2734 | Wax Model of the Face of a Man affected with Acne Indurata. | | |
| 2734 ^A | Wax Model of the Face, affected with Acne Indurata. | | |
| 2735 | Wax Model of the lower part of the Face of a Man affected with Sycosis. | | |
| 2736 | Wax Model of the Face of a Man affected with Lupus. | | |
| 2736 ^A | Wax Model of the Face of a Man affected with Lupus, or Scrofulous Ulcerations. | | |
| 2736 ^B | Wax Model of the Face of a Woman greatly disfigured by Lupus. | | |
| 2736 ^C | Wax Model of a Face, the greater part of the Nose, and surrounding parts, destroyed by Lupus. | | |
| 2736 ^D | Wax Model of the Neck and Chest affected with Lupus, and presenting Scars, apparently the result of the same disease. | | |
| 2736 ^E | Wax Model of the Face of a young Man affected with Elephantiasis, which also affected some other parts of the body. (See Model 2736 ^F , and Skull No. 93 ^F .) | See Case of F. Hawkesford, 3d Misc. Insp. Bk., page 88 | |
| 2736 ^F | Wax Model of the Thigh of a young Man affected with Elephantiasis. (See Model 2736 ^E , and Skull No. 93 ^F .) | See Case of F. Hawkesford, 3d Misc. Insp. Bk., page 88. | |
| 2736 ^G | Wax Model of the Face of an Infant affected with Venereal Blotch. | | |
| 2736 ^H | Wax Model of the Face of a Child, 2 months old, affected with Venereal Blotch. | See Case of J. Crabb. | |
| 2736 ^I | Wax Model of the Face of an Infant affected with Venereal Blotch. | | |
| 2736 ^J | Wax Model of the Arm of a Child affected with Venereal Blotch. | | |
| 2736 ^K | Wax Model of the Breast and Arm of a Child affected with Venereal Blotch, ulcerating. | | |
| 2736 ^L | Wax Model of the Back and Nates of a Child affected with Venereal Blotch, ulcerating. | | |
| 2736 ^M | Wax Model of an Infant affected with Venereal Blotch, partially ulcerated, with great Venereal Petechiæ. | | |
| 2736 ^N | Wax Model of a Hand, the Palm of which is affected with Venereal Blotch. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|-----------------------|---------------------------------------|
| 2736 ^O | Wax Model of an Arm and Hand of an Adult, affected with Venereal Blotch. | | |
| 2736 ^P | Wax Model of part of an Arm affected with Venereal Blotch; which, near the Elbow, has produced a large Granulating Ulcer. | | |
| 2736 ^Q | Wax Model of the Face of a Man with a large Venous Nævus, occupying the greater part of the right Side of the Face. (See Model 2736 ^R .) | | |
| 2736 ^R | Wax Model of the same subject as the preceding, taken some months after, when the Nævus was greatly increased in size, notwithstanding an attempt to repress it by a ligature. (See Model 2736 ^Q .) | | |
| 2736 ^S | Wax Model of part of the Chest and Abdomen of a little Boy, with a large dark brown Nævus. | | |
| 2736 ^T | Wax Model of the Face of a Man, with a horny growth: this is its second appearance. The first was five years growing, and not quite so large as the present one. It was removed by operation. The present is the growth of one year, and still increasing in size. | | |
| 2736 ^U | Wax Model of the Arm and Hand of a Child affected with hairy Nævus. (See Drawing by C. J. Canton.) | | |
| 2737 | Wax Model of part of a Leg; representing a rapidly-healing Ulcer. | | |
| 2737 ^A | Wax Model of an indolent Ulcer. | | |
| 2738 | Wax Model of a Leg; representing a very indolent Ulcer, with a ragged elevated surface. | | |
| 2739 | Wax Model of the Arm; showing a large and foul Ulcer, the result of Syphilis and Mercury. | | |
| 2740 | Wax Model of a Leg affected with common Chronic Ulcer. | | |
| 2740 ^A | Wax Model of a Leg affected with Chronic Ulcer on the Shin, which has laid bare the Tibia. The patient's constitution was destroyed by intemperance. | | |
| 2740 ^B | Wax Model of part of a Leg and Foot affected with chronic Ulcers, and deep cellular membranous Sores; from a Man whose constitution was broken by intemperance and Syphilis. | | |
| 2740 ^C | Wax Model of the lower part of the Leg and Foot affected with Ulcers accompanying Varicose Veins. | | |
| 2740 ^D | Wax Model of a Hand affected with Scrofulous Ulceration of the Skin? | | |
| 2740 ^E | Wax Model of the side of a Face affected with Ulceration on the Forehead and near the Ear. It was of an obstinate character, and was supposed to be scrofulous; but there was some suspicion that it had been produced by infection from a glandered horse. This man was a servant to J. H. Sheehane, of Odiham. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|-----------------------|---------------------------------------|
| 2740 ^F | Wax Model of a Hand affected with large deep untractable Ulcers, with elevated edges; produced by the poison of Glanders. | | |
| 2740 ^G | Wax Model of a Foot with large untractable Ulcers on the Sole; produced by the bite of a snake. The accident happened abroad, and the species of snake not known. | | |
| 2740 ^H | Wax Model of a Back affected with Cutaneous Fungoid Tumors. | | |
| 2740 ^I | Cast of the fore part of the Arm, affected with numerous Subcutaneous Fungoid Tumors. From a patient in Ward. | | |
| 2740 ^J | Wax Model of a Leg affected with Warty Fungus, and Fungoid Tumors of the Skin: the Bone also affected. (See Drawing.) | | |
| 2740 ^K | Wax Model of the Foot of a young Woman, affected with Melanotic Cutaneous Tumors. They were removed by operation; but the disease appeared in the Inguinal Glands, and the patient sunk in three months. (See Prep ^s . 1661 A.) | | |
| 2740 ^L | Plaster Cast of the Abdomen of an elderly Woman, greatly enlarged by Œdema of the Subcutaneous Cellular Membrane, the Cells of which were, probably, much dilated. From a patient of Dr. Addison's, in Miriam's Ward. | | |
| 2740 ^M | Wax Model of a part of the Abdomen, shewing the distended Texture of the Skin, and the Cuticle vesicated. There was an abundant flow of Serum. | | |
| 2741 | Wax Model of part of the Arm, affected with Cellular Membranous Sores. | | |
| 2741 ^A | Wax Model of an Arm affected with large and deep Cellular Membranous Sores, in a person long given up to intemperance and prostitution. | | |
| 2742 | Wax Model of a Knee affected with Cellular Membranous Sores. | | |
| 2743 | Wax Model of part of a Leg affected with Cellular Membranous Sores. | | |
| 2743 ^A | Wax Model of a Leg affected with Cellular Membranous Sores, apparently sequel to Ecthyma, and affected with Varicose Veins. | | |
| 2744 | Wax Model of part of the side of a Face; shewing Scrofulous Ulcers over the Parotid Gland. | | |
| 2744 ^A | Wax Model of the lower part of the Thigh and Knee, affected with a Subcutaneous Fungoid Tumor, of the size of an orange, with slight and diffused ulceration of the superjacent skin. (See Prep ^s . 1660 C.) | | |
| 2744 ^B | Wax Model of an ulcerated Subcutaneous Fungoid Tumor on the fore part of the Thigh of a Man; taken after death. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|-----------------------|---------------------------------------|
| 2744 ^C | Wax Model of a Hand with deep and extensive Ulceration on the Back; the bone apparently affected. | | |
| 2744 ^D | Wax Model of the Foot of a Man, affected with malignant Ulcer near the first joint of the great Toe. There seems to have been malignant Exostosis from the head of the bone. | | |
| 2744 ^B | Wax Model of a Leg, with a deep Funginating Ulcer, exposing a large portion of Necrosed Tibia. | | |
| 2745 | Cast of the Face, Neck, and Breast of a Girl; the chin bound down to the bosom, by the contraction of a large cicatrix of a burn. | | |
| 2746 | Another similar Specimen; in which the mouth is kept open by the depression of the under-lip. | | W. T. J.iff, Esq. |
| 2747 | Another similar Specimen; the chin not quite so much depressed, but the under-lip much more so: the arm is confined to the side, and the fore arm kept permanently flexed by a web-like process of new cutis. Taken from a Girl, a patient of C. A. Key, Esq. | | |
| 2747 ^A | Cast of the fore Arm and Hand, with a large Cicatrix on the Arm, the contraction of which has flexed the wrist, and drawn the thumb towards the elbow. | | |
| 2748 | Bust of a young Woman with a Steatomatous Tumor, commencing near the top of the Head, and hanging down on the right Shoulder, beyond which it projected to a considerable distance. It was removed at St. George's Hospital, by Sir Everard Home. The patient is said to have been very little disfigured after the operation. | Cat. II. 2. | Brookes's Collection. |
| 2749 | Cast of the Leg and Foot of a young Woman; the former very considerably enlarged, from a disease of the Subcutaneous Cellular Membrane. | | |
| 2750 | Cast of the same Leg after it had been amputated; the disease having produced a still greater increase of size. | | |
| 2750 ^A | Wax Model of the Hands of a Woman, shewing the Nails of distorted figure and morbid growth, the result of Impetigo near the extremities of the Fingers. | | |
| 2751 | Mask from an old Man, whose Frontal Sinuses were kicked in by a horse. | | |
| 2752 | Mask, shewing the Nose in a great measure destroyed by Lupus. | | |
| 2752 ^A | Wax Model of the Face of a Child. The greater part of the Nose, Lips, and Mouth destroyed by Sloughing (Cancrum Oris). | | |
| 2752 ^B | Wax Model of the Face of a Man, affected with Fungoid disease of the Antrum Maxillare. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|--|---------------------------------------|
| 2753 | Cast of the fore part of a Head and Neck, from a patient in the Middlesex Hospital, who had lost the greater part of his Face from Carcinoma or Noli-me-tangere: the Nose, Palate, and one Eye destroyed; the other Eye nearly loose, having lost the greater part of its orbit. | Cat. ix. 1. | Brooke's Collection. |
| 2754 | Wax Cast of the left side of the Face; shewing a small Fistula Lachrymalis. | Cat. cccxxx 2. | |
| 2755 | Wax Model of the greater part of the right side of the Face; shewing the Eye, affected with Staphyloma. | | |
| 2756 | Cast of the Head and Face of a Child, seven years of age, with a very large Fungoid Tumor proceeding from the left Eye. A large part of the surface of the Tumor ulcerated. | Cat. cciv. 2. | Brooke's Collection. |
| 2757 | Bust of a Woman, in whom both Eyes are closed by large Tumors protruding from the Orbita. The patient, a Fish-woman at Billingsgate, for a long time after these Tumors had commenced, was still able to pursue her occupation: she fell in an Apoplectic Fit in Billingsgate; and was brought to St. Thomas's Hospital, where she died. The Tumors were Osteo-cartilaginous Exostoses. The Skull is preserved in the Museum at St. Thomas's. | Cat. ccxxii. 2. | Brooke's Collection. |
| 2757 ^A | Wax Model of a Bony Tumor spontaneously detached to the Orbit of a Man, 24 years of age, a patient of J. Morgan, Esq., in Nauman's Ward. (See a Drawing of the Face by C. J. Canton.) | See Guy's Hospital Reports, Vol. I. Case by J. Hill-ton, Esq. | |
| 2758 | Wax Model of the Face of an aged person, with a large Ulcerated Fungoid Tumor growing from the left Eye. | | |
| 2759 | Bust of a Child, with a large Ulcerated Fungoid Tumor growing from the left Eye. | Cat. ccxi. 2. | Brooke's Collection. |
| 2759 ^A | Wax Model of the Face of a Man, with malignant Tumor and Ulceration on the left Orbit, displacing the Eye, and extending to the surrounding parts. | | |
| 2759 ^B | Wax Model of the Face of a Boy, both of whose Eyes were affected with Fungus Hæmatodes. The left was extirpated, but the disease extensively invaded the surrounding parts. The Lad was a patient of Mr. Lawrence, at Brighton. | | |
| 2759 ^C | Wax Model of an Eye affected with white Medullary Fungus; which having commenced in the Retina, near the central Artery, has occasioned absorption of the vitreous humor; and advanced almost to the anterior chamber, and caused opacity of the Lens. The form of the Globe is not altered. The disease appears to have extended within the sheath of the Optic Nerve. (See J. Dalrymple's 3d Plate, Fig. 9.) | See a Paper by J. Dalrymple, Esq. | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|--|---------------------------------------|
| 2759 ^D | Wax Model of the left Eye of a Child, 2½ years old, with Fungoid disease. The Sclerotic coat was thickened posteriorly. The Iris, and the Lens and its Capsule, both of which had become opaque, pushed forward by a pedunculated Fungoid mass, proceeding from near the insertion of the Optic Nerve. The Optic Nerve considerably wasted. In the right Eye the disease had made much further progress. (See J. Dalrymple's 3d Plate, Fig. 3.) | See a Paper by J. Dalrymple, Esq. | |
| 2759 ^E | Wax Model of the Section of the Eye of a Child, 3½ years of age, affected with Fungoid disease. It commenced by four Tubercles within the Ball, at the posterior part. It distended the Eye; and caused a small slough on the Cornea. A cerebriform mass was formed behind the Eye. The Optic, the 3d, and part of the 5th Nerves were implicated, and disorganized in it. The patient had suffered great pain of Forehead. (See Plate 3. Fig. 10. of J. Dalrymple's Paper.) | See a Paper by J. Dalrymple, Esq. | |
| 2759 ^F | Wax Model of the Eye of a Child, about 4 years of age, affected with Fungoid disease. The Globe of the Eye burst anteriorly; and collapsed upon some Fungoid growths within. Several Fungoid growths behind the Ball of the Eye caused it to protrude from the Orbit. The Optic Nerve stretched, but thickened by disease. (See J. Dalrymple's 2d Plate, Fig. 7.) | See a Paper by J. Dalrymple, Esq. Case of George Bottaril | |
| 2760 | Wax Model of the Face of a Woman affected with Melanosis of the left Eye. There is a similar Tumor, of more recent formation, near the angle of the Lower Jaw, on the same side. From a patient of M. Gossett, Esq. | | |
| 2761 | Plaster Model of the Face of a Child affected with Hare-Lip. | | |
| 2761 ^A | Mask of a Child affected with Hare-Lip, with irregularity of the Incisors, and some displacement of the Nostril on the right side. (See Prep ⁿ . 1682 ^B .) | | |
| 2762 | Plaster Cast of the Mouth and Nose of a Man affected with Hare-Lip; with a deficiency of the Palate, extending to the left Nostril. | | |
| 2763 | Similar Cast, from the same individual, after the operation for Hare-Lip had been performed by C. A. Key, Esq. | | |
| 2764 | Plaster Cast of the Nose, Mouth, and Chin of an old Woman affected with Hare-Lip. | | |
| 2765 | Plaster Model of the Face of a Child affected with double Hare-Lip. | | |
| 2766 | Plaster Model of the Face of a Child affected with double Hare-Lip, the middle portion forming a projection in continuation of the Septum of the Nose. | | |
| 2767 | Cast in Wax, of a Case of Cancer of the Lip. | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|--|---------------------------------------|
| 2767 ^A | Cast of the lower part of the Face, from a person affected with Cancer of the Lip. | | |
| 2768 | Wax Model of the Nose and Mouth; shewing a very considerable destruction of the soft parts, from Lupus or Cancer. | | |
| | (4.) <i>Models and Casts supplementary to Section V.</i> | | |
| 2769 | Bust of a middle-aged Female affected with Gout or Bronchocele, and apparently a Cretin. This individual, and two of her relatives, were exhibited in London, a few years ago. | Cat. cccxiv. 2. | Brookes's Collection. |
| 2770 | Cast of the Face, Neck, and Breast of a Female affected with a large Bronchocele. From a patient of C. A. Key, Esq. | | |
| | (5.) <i>Models and Casts supplementary to Section VI.</i> | | |
| 2771 | Wax Model of the Mouth, from which several of the Teeth are gone; shewing a large Fungoid Tumor growing from the Gums of the lower Jaw. | | |
| 2771 ¹ | Cast of the Cheek, and side of the Neck; shewing a Tumor, occasioned by obstructed Maxillary Gland. | | |
| 2771 ² | Cast of the side of a Face and Neck; shewing a Tumor occasioned by an obstructed Maxillary Gland, attended with external sore. | | |
| 2771 ^A | Plaster Cast of the Face of a Woman, with a large Tumor occupying the left side of the Face and Chin, and Fungoid disease commencing in the Alveolar process. | | |
| 2771 ^B | Cast of the Face of an elderly Man, affected with Fungoid Tumor attached to the lower Jaw on the right side. It commenced in the Gums, and was removed by operation; but the disease returned. From a patient of J. Morgan, Esq., in Luke's Wax. (See Prep ^s . 1683 ^A .) | | |
| 2772 ¹ | Wax Model of the Stomach, with a well-defined Chronic Ulcer at its smaller curvature. The surrounding Mucous Membrane intensely injected. (See Prep ^s . 1801 ^A .) | 9th Green Inspection Book, page 74. Case of W. Fairbrother. | |
| 2772 | Wax Model of a portion of small Intestine which had been strangulated. | | |
| 2772 ^A | Wax Model of the Stomach of a Woman accidentally poisoned by Arsenic. She was a patient of J. Hardy, jun., Esq. | | |
| 2772 ^B | Wax Model of the Stomach and Duodenum of a Female, poisoned by Arsenic. | Vide Ante, p. | |
| 2772 ^C | Wax Model of the Stomach of a young Woman, poisoned by Arsenic. | See a Paper by A. Taylor, Esq. Guy's Hospital Reports, Vol. II. p. 67. | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|--|--|---------------------------------------|
| 2772 ^b | Wax Model of the Stomach and Duodenum of a Dog, poisoned by Arsenic. | See a Paper by Dr. Hodgkin. | |
| 2772 ^c | Wax Model of the Stomach and Duodenum of a Horse, poisoned by Arsenic. | See a Paper by Dr. Hodgkin. | |
| 2772 ^f | Wax Model of the Stomach and Duodenum of a Horse, poisoned by Corrosive Sublimata. | See a Paper by Dr. Hodgkin. | |
| 2773 | Plaster Cast of the Abdomen; shewing the Intestines, both large and small, greatly distended, from a Stricture of the Colon near its termination. (See Prep ^a . 1854.) | 3d Green Inspection Book, page 10. Case of Donald Hart. | |
| 2774 | Wax Model of a portion of the Colon; the internal surface thickened, granular, and highly vascular, from severe inflammation. (Dysentery.) | | |
| 2775 | Wax Model of a portion of the Colon; the external surface of a dark colour, with a greenish-olive tinge: the Mucous Membrane of this Intestine is wholly destroyed, either by Ulceration or Sphecelus. Copied from a specimen taken from a patient of Dr. Addison's. | | |
| 2776 | Plaster Cast, shewing a considerable Prolapsus of the Anus. | | |
| 2776 ^A | Cast of the Anus, affected with Prolapsus of the Mucous Membrane, and Piles. | | |
| 2776 ^B | Plaster Cast of two large irregular Scybala. | | Presented by Dr. Blandell. |
| 2777 | Plaster Cast of a Liver, of very small size and irregular form. The Gall-bladder considerably displaced; the effect of contraction of the thickened Peritoneal Coat and interlobular Cellular structure. | | |
| 2777 ^A | Cast of a Liver, distorted and contracted from disease of the structure between the Acini. The Gall-bladder much distended. | | |
| 2778 | Wax Model of a portion of Liver, which was of large size, and far advanced in the fatty degeneration. The Gall-bladder also greatly enlarged. | | |
| 2779 | Cast of a Liver of considerable size; the surface of which is marked by numerous mammillated elevations and puckered depressions, from thickening and induration of the Cellular Structure between the Acini. (See Prep ^a . 1907 ^A .) | 5th Green Inspection Book, page 102. Case of M. Patterson. | |
| 2780 | Wax Model of a portion of the Liver, from which the preceding Cast was taken; shewing the thickened Cellular Tissue and fleshy Acini. | | |
| 2781 | Cast of a Liver, containing numerous Fungoid Tubercles. The patient had a Scirrhus Mamma. (See Prep ^a . 1780, 1922, and 2317.) | 3d Green Insp. Book, p. 1A. Case of S. Gregory. | |
| 2782 | Wax Model of a portion of Liver, containing a large well-defined Fungoid Tubercle. (See Prep ^a . 1928 ^A .) | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|--|---|---|--|
| 2782 ^A | Cast of a Liver, greatly enlarged, and containing several white Fungoid Tubercles of remarkably large size. From a patient of R. Robinson's. (See Prop ^a .) | Case reported to the Hunterian Society. | From a Preparation presented by R. Robinson. |
| 2782 ^B | Cast of a Liver of large size, which contained numerous Fungoid Tubercles. From a patient of Dr. Stroud's. (See Prop ^a . 1963 ^A ; and Drawing, No. .) | | From a Preparation presented by Dr. Stroud. |
| 2783 | Cast of a greatly-enlarged Spleen. | | |
| (6.) <i>Models and Casts supplementary to Section VII.</i> | | | |
| 2784 | Wax Model of a Kidney, affected with the Chronic form of the white mottling Deposit described by Dr. Bright. | | |
| 2784 ^A | Wax Model of a Kidney, in which the white Deposit described by Dr. Bright has affected the whole of the Cortical substance. | | |
| 2784 ^B | Wax Model of the other Kidney, belonging to the subject from which the preceding specimen was taken: it is shown in Section. | | |
| 2785 | Plaster Cast of two Kidneys, of which the Infundibula are much thickened. | | M. T. ISS, Esq. |
| 2786 | Plaster Cast of the Abdomen; from an individual of about fourteen years of age, of doubtful gender, and in whom the anterior portion of the Bladder is wanting; the Ureters opening externally. | | |
| 2786 ^A | Plaster Cast of the lower part of the Abdomen of a Boy, in whom the anterior part of the Bladder is wanting. The Penis is small, and cleft upon its upper surface. There appears to be Hernia on the left side. | | |
| 2787 | Plaster Cast, from a Man, aged about 33 years, in whom the anterior part of the Bladder was deficient: the Ureters terminated in the Fungous Excrescence; and the Umbilicus was situated at the upper part of it. | | |
| 2787 ^A | Plaster Cast of the lower part of the Abdomen: the anterior part of the Bladder is wanting: the Penis cleft upon its upper surface, exposing the Urethra as a groove. | | |
| 2787 ^B | Cast of the lower part of the Abdomen of a supposed Hermaphrodite, from Germany: the parts appear to be those of an imperfect Male. | | |
| 2787 ^C | Cast of the Pubic region of a Male subject; in which the Penis was small and imperfect, and the Urethra open superiorly. | | Dissecting Room. |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|---|--|--|---------------------------------------|
| 2788 | Plaster Cast of part of the Abdomen of a Man, in whom there was a red granulating surface, rather larger than a crown-piece, a little below the Umbilicus; surrounding a Fistulous opening, which communicated with the Fundus of the Bladder, and allowed the constant escape of urine. | | |
| (7.) <i>Models and Casts supplementary to Section VIII.</i> | | | |
| 2789 | Plaster Cast of the Pubic region and Perineum of a Female; shewing the effects of very extensive and deep Phagedenic Ulceration: both Ossa Pubis and part of the right Ischium completely exposed. (Venereal.) | | |
| 2790 | Plaster Cast of the left side of the Breast; showing the Mamma greatly enlarged by malignant disease, and accompanied with numerous subcutaneous Tubercles. (See Cast of the Liver, Prep ^s . 1786, 1922, and 2317.) | 24 Green Inap. Book, page 12. Case of S. Gregory. | |
| 2790 ¹ | Cast of the Bosom of a Girl, about 13 years of age, in which the Mamme are preternaturally large. Other symptoms of puberty had scarcely, if at all, appeared. | | |
| 2790 ^A | Wax Model of the left side of the Chest of a Female, with a very large Fungoid Tumor growing from the Mamma. The skin is ulcerated and tuberculated; and the Axillary and Cervical Glands enlarged by the same disease. | | |
| 2791 | Wax Model of a Female Mamma, affected with Cancer, and deeply ulcerated. | | |
| 2792 | Cast of the anterior part of the Thorax of a Female patient of C. A. Key, Esq., affected with Ulcerated Cancer of the left Mamma. (See Prep ^s . 1161 and 1162. Cancerous Tubercles found in the Femur of the same subject.) | | |
| 2793 | Cast of the left side of the Chest; the Mamma affected with Cancer or Fungoid disease, with extensive ulceration. | | |
| 2794 | Plaster Cast of a Mamma affected with extensive ulceration. | | |
| (8.) <i>Models and Casts supplementary to Section IX.</i> | | | |
| 2795 | Cast, showing a large Fungating Granulation; probably the result of an Abscess in the Testicle. | | |
| 2795 ^A | Cast of the lower part of the Abdomen, with one of the Testicles prodigiously enlarged by Fungoid disease. | | A. Dahymple, Esq. Norwich. |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History. | By whom presented, or whence derived. |
|-------------------|---|-----------------------|---------------------------------------|
| 2795 ^B | Cast of the lower part of the Abdomen, and part of the Thigh; shewing the left Testicle greatly enlarged by Fungoid disease. From a patient of J. Morgan, Esq. | | |
| 2795 ^C | Wax Model of the lower part of the Abdomen of a Child, having a large Tumor caused by Fungoid disease of the Testis. From a patient of M. Gossett, Esq. | | |
| 2795 ^D | Wax Model of the same Tumor, taken after death, when it had increased in size and become ulcerated. The child was two years old. (See Prep ^a . .) | | |
| 2796 | Cast of the lower part of the Abdomen; shewing a large Fungoid Ulceration in the right Groin. Taken from a patient of J. Morgan, Esq. The Testicle had been removed for Fungoid disease, which re-appeared in the Cord. The patient died, exhausted by repeated hæmorrhage. Neither the Glans in the Pelvis, nor any other part of the body, participated in the disease. | | |
| 2797 | Plaster Cast of a Case of Hydrocele. | | |
| 2798 | Plaster Cast of a Case of Elephantiasis of the Scrotum. | | |
| 2798 ^A | Small Model of Hoo Loo, taken prior to his leaving China: Scrotum affected with Elephantiasis, reaching to the Knees. | | Presented by Mr. Henry. |
| 2798 ^B | Plaster Cast of the Abdomen and Thighs of Hoo Loo; shewing the Scrotum prodigiously enlarged by Elephantiasis. (See Prep ^a . , Drawings, No. . . , and Cast, No. 2619 ^A .) | | |
| 2799 | Plaster Cast, exhibiting Chimney-sweeper's Cancer, affecting the Scrotum. | | |
| 2800 | Plaster Cast; shewing the same disease, from another subject. | | |
| 2801 | Wax Model of an Ulcer on the Scrotum, from Chimney-sweeper's Cancer. | | |
| 2801 ^A | Wax Model of the Bladder and Urethra; shewing the three Lobes of the Prostate Gland greatly enlarged by Fungoid disease. A false passage had been formed at the side of the Urethra, and entered the Bladder through the middle Lobe of the Prostate. | | |
| 2802 | Plaster Cast of the Abdomen and upper part of the Thighs; shewing very extensive Phagedenic Ulceration. (Venereal.) | | |
| 2803 | Plaster Cast of the Pubic Region; shewing the Penis greatly mutilated from Phagedenic Ulceration. (Venereal.) | | |

Wax Models and Casts.

| N ^o . | DESCRIPTION. | Reference to History | By whom presented, or whence derived. |
|-------------------|---|--|---------------------------------------|
| 2803 ^I | Cast of the Pubic Region of a Man; the Penis lost by Sloughing. (See Wax Model 2736 ^I .) | | |
| 2803 ^A | Cast of the Pubic Region of a Man; with a Penis distorted, and constrained by old Adhesions; and the remains of the Prepuce forming two fleshy Tumors on each side of the Frænum. The result of old extensive Venereal Sores. | 8th Green Insp. Book, page 48. Case of — Spencer, aged 34. | |
| 2804 | Wax Model of a Penis; the Glans and Prepuce affected with numerous Ulcerations. | | |
| 2804 ^A | Wax Model of a Penis; the Glands and Prepuce partially destroyed by deeply-ulcerated Ulcers. | | |
| 2804 ^B | Wax Model of a Penis, with a deep defined Ulcer immediately behind the Glands. | | |
| 2804 ^C | Wax Model of a Penis; the Glands in a great measure destroyed by Phagedenic Ulceration, attended with Hæmorrhage;—the Corpora Cavernosa exposed. | | |
| 2804 ^D | Wax Model of a Penis; with an extensive, deep, and foul Ulcer spreading from the Frænum, and two smaller Ulcers on the Dorsum behind the Glands. | | |
| 2805 | Wax Model of a Penis; the Glands and Prepuce in a great measure removed by Phagedenic Ulceration. The Integuments swollen and oedematous. (See Drawing 234.) | | |
| 2806 | Wax Model of a Penis; the Glans ulcerated and protruding through an Ulcerated Opening in the Prepuce. The anterior part of the Prepuce much swollen with Oedema. | | |
| 2807 | Wax Model of a Penis; shewing numerous Venereal Warts on the Glans and Prepuce. | | |
| 2808 | Wax Cast of a Penis; shewing Cancer of the Prepuce. | | |
| | (9.) Models and Casts supplementary to Section X. | | |
| 2809 | Plaster Cast of Inguinal Hernia on the right side. | | |
| 2810 | Plaster Cast of Inguinal Hernia on the left side. | | |
| 2811 | Plaster Cast of Inguinal Hernia on the right side. (Scrotal.) | | |
| 2811 ^A | Cast of the lower part of the Abdomen and Thighs; shewing Femoral Hernia. | | |
| 2811 ^B | Cast of a large Scrotal Hernia. | | |
| 2812 | Plaster Cast of a very large Scrotal Hernia. | | |
| 2813 | Plaster Cast of a very large Scrotal Hernia, almost descending to the Knee. (See the Sac.) | 1st Green Insp. Book, page 81. Case of James Ward. | |

